

FLORA OF ASSAM

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GRAMINEÆ

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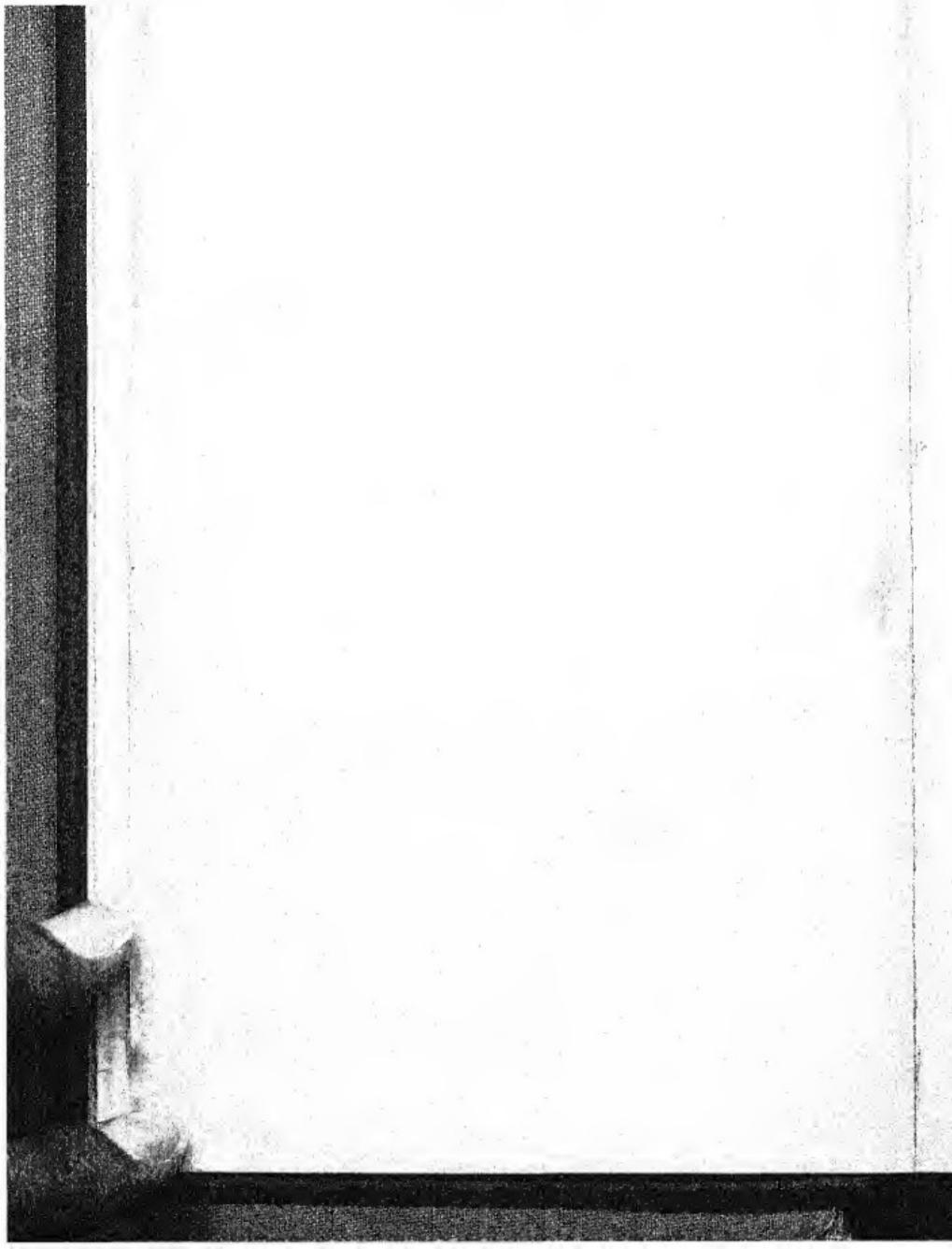
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FOREWORD

This account of the Gramineæ of Assam is based upon the collections housed in the herbaria at Kew, Calcutta, Dehra Dun and Shillong which have been examined through the courtesy of the Directors. Capt. Kingdon-Ward, the explorer botanist, when touring in the Balipara Frontier Tract was good enough to put together a collection of grasses which he sent to the author at Dehra Dun. This gathering added many new records to the known grass flora. It can with confidence be stated that the systematic collection of these interesting plants in the higher regions of the Eastern Himalaya will add appreciably to the number of species which have been described in this book.

In the descriptions of genera and species I have had no hesitation in borrowing from others where an excellent description of a species or genus was in existence. In this respect I am much indebted to the giants of old, Eduard Hackel and Otto Stapf and, of the modern agrostologists, to A. Camus and C. E. Hubbard. The latter has always been ready to answer my repeated and often tedious questions. His exhaustive treatment of the *Gramineae* in Hutchinson's Families of Flowering Plants, Vol. II, has been a real source of inspiration and guidance and I have borrowed largely from it. Mr. V. Narayanaswami of the Botanical Survey of India, has placed his knowledge of the literature relating to grasses at my disposal and I have made full use of it. The Curator of the Herbarium, Royal Botanic Garden, Sibpur, has been most kind in sending me sheets of material which I wished to examine.

N. L. Bor.



FLORA OF ASSAM

GRAMINEÆ.

Annual or perennial herbs, rarely shrubs or trees; stems erect, ascending or prostrate and creeping, usually branched at the base, in perennials forming sterile shoots (innovations) and flowering stems (culms), in annuals only the latter present; culms cylindrical, rarely flattened, jointed, usually hollow in the internodes, closed at the nodes. *Leaves* solitary at the nodes, sometimes crowded at the base of the stems, alternate and two-rowed, consisting of sheath, ligule, and blade; sheaths encircling the culm, with the margins free and over-lapping or more or less connate, frequently swollen at the base (sheath-node); ligule placed at the junction of the sheath and blade, membranaceous or reduced to a fringe of hairs, rarely absent; blades usually long and narrow, rarely broad, usually passing gradually into the sheath, rarely with a petiole-like base, flat, convolute or involute or terete, parallel-nerved. *Flowers* usually hermaphrodite, sometimes unisexual, small and inconspicuous, usually consisting of stamens and pistil and of 2 or 3 minute hyaline or fleshy scales (lodicules) representing the perianth, sub-sessile between two bracts (lemma and palea), the whole forming a floret or false flower. *Florets* one to many, distichous, sessile on a short or minute slender axis (rhachilla) and bearing at the base two empty bracts (upper and lower glume), the florets and glumes forming a spikelet. *Spikelets* pedicelled in open or contracted panicles or racemes, or sessile in spikes. *Stamens* hypogynous, 1 to 6, rarely more, usually 3, with delicate filaments and 2-celled anthers, the latter opening usually by a longitudinal slit; ovary 1-celled, with one anatropous ovule often adnate to the adaxial side of the carpel; styles usually 2, rarely 1 to

3; stigmas generally plumose; fruit mostly a caryopsis with a thin pericarp adnate to the seed, or rarely a nut or a berry or a utricle with a free pericarp, with starchy endosperm and a small embryo at the base on the abaxial face.

Key to the sub-families of the *Gramineæ*.

Spikelets 1- to many-flowered, breaking up at maturity above the more or less persistent glumes, or if falling entire then not 2-flowered with the lower floret male or barren and the upper hermaphrodite, usually more or less laterally compressed or terete. **Pooideæ.**

Spikelets 2-flowered, falling entire at maturity, usually with the upper floret fertile and the lower male or barren and in the latter case often reduced to the lemma, all alike or different in size, shape and structure, frequently dorsally compressed. **Panicoideæ.**

Key to the tribes of the *Pooideæ* (after Hubbard).

- A. Shrubs or trees with woody often tall persistent culms; leaf-blades flat, many-nerved, often with transverse veins, usually with a petiole-like base which is articulated with the sheath; spikelets bi-sexual; lemmas 5- to many-nerved, usually awnless; lodicules usually 3; stigmas mostly 2 or 3. **1. Bambuseæ.**
- AA. Perennial or annual herbs; leaf-blades usually sessile and not articulated with the sheaths.
- B. Spikelets borne in open or contracted or spike-like panicles, less often in racemes or spikes, and then with the lower or both glumes suppressed if on opposite sides of a continuous rachis, or with 2 or more fertile florets if on one side of the rachis.
- C. Spikelets usually with 2 or more fertile florets, or if with 1 fertile floret then with sterile florets above it.
- D. Lemma and rhachilla glabrous or hairy, in the latter case with the hairs not enveloping the lemma or if so then with the lemma bearing a geniculate awn; low or moderately tall grasses.
- E. Glumes usually shorter than the lowest floret and with the upper florets distinctly exserted, rarely longer and then usually with firm dull margins like the lemmas; lemmas awnless or with a straight or curved awn from the entire or bifid apex, or several-awned or lobed.
- F. Lemmas usually 5- to many-nerved.
- G. Leaf-blades broad, many-nerved with transverse veinlets.
- GG. Leaf-blades flat, convolute or involute without transverse veins. **2. Centotheceæ.**
- FF. Lemmas 1- to 3-nerved. **3. Festuceæ.**
- 6. Eragrosteæ.

- EE. Glumes usually as long as or longer than the lowest floret, often as long as the spikelet and enclosing the florets; lemma awnless or more often awned from the back or the sinus of the 2-lobed tip; the awn usually geniculate; glumes or lemmas or both frequently with thin shining margins. **9. Aveneæ.**
- DD. Lemmas or rhachilla joints bearing long silky hairs which envelop the lemma (at least in fertile florets); lemmas awnless or with a straight awn from the tip, often thin; tall grasses with usually large plume-like panicles. **5. Arundineæ.**
- CC. Spikelets with 1 fertile floret (male or female in unisexual 1-flowered spikelets) with or without 1 or 2 male or barren florets below it.
 - H. Glumes very minute or suppressed; palea 3- to 9-nerved; stamens usually 6; leaf blades not transversely veined. **14. Oryzeæ.**
 - HH. Glumes usually well developed, at least the upper, rarely minute or suppressed.
 - I. Spikelets with 3 florets, the lower 2 florets male or barren and the terminal hermaphrodite. **13. Phalarideæ.**
 - II. Spikelets with 1 or 2 florets.
 - J. Spikelets with 2 florets, the lower male or barren the upper hermaphrodite.
 - K. Lower floret barren and without a palea; glumes up to half the length of the spikelet; rhachilla produced beyond the upper floret; spikelets disarticulating with part of the pedicel attached. **15. Thysanolæneæ.**
 - KK. Lower floret male or barren usually with a palea; upper glume as long as the spikelet; rhachilla disarticulating below the upper floret and not produced beyond it; glumes more or less persistent. **16. Arundinelleæ.**
- JJ. Spikelets with 1 floret.
- L. Spikelets usually breaking up at maturity, the rhachilla disarticulating above the more or less persistent glumes, very rarely falling entire and then with firmly membranous, awned or 5-nerved lemmas.
- M. Lemmas hyaline or membranous at maturity, rarely indurated and then laterally compressed, awnless or awned from low down on the back or from the entire or bifid tip.
- N. Lemmas usually 3- to 5-nerved, frequently awned; glumes firmer and longer than the hyaline lemma or if shorter than the lemma, herbaceous-membranous and dull; grain usually with an adhering pericarp. **10. Agrostææ.**
- NN. Lemmas 1- to 3-nerved, awnless; glumes and lemma very similar in texture, hyaline or thinly membranous, shining; grain usually with a free pericarp. **7. Sporoboleæ.**
- MM. Lemmas indurated and rigid at maturity, terete or dorsally com-

pressed, with involute or convolute margins, tightly enveloping the grain, with a terminal awn or sometimes awnless.

11. Stipeæ.

- LL. Spikelets falling entire at maturity, either singly or in clusters from the axis of slender spike-like panicles or racemes; lemma delicate, 1- to 3-nerved.

12. Zoysieæ.

- BB. Spikelets sessile or shortly pedicelled along one side of the rhachis of solitary, digitate or scattered spikes or spike-like racemes (with 1 fertile floret and 1- to 3-nerved lemmas), or on the opposite sides of the rhachis of solitary spikes or racemes.

- O. Spikelets on opposite sides of the rhachis of solitary spikes.

4. Hordeæ.

- OO. Spikelets in one or two rows on one side of the usually continuous rhachis of digitate spikes.

8. Chlorideæ.

Key to the tribes of the Panicoideæ.

- A. Spikelets all hermaphrodite, with male or barren or hermaphrodite spikelets mixed in the same inflorescence and so arranged that a male or barren spikelet is near a hermaphrodite spikelet, if unisexual then the lemma of the fertile floret indurated.

- B. Spikelets solitary or paired, more or less similar; glumes usually membranous, the lower usually smaller or sometimes suppressed; lower lemma mostly resembling the upper glume in texture; upper lemma papery to very tough and rigid, usually awnless.

17. Paniceæ.

- BB. Spikelets often paired, with one sessile and the other pedicelled, those of each pair similar or more often dissimilar, rarely solitary and all alike; glumes as long as the spikelet and enclosing the florets, more or less rigid and firmer than the lemmas which are both hyaline or membranous; upper lemma usually awned.

18. Andropogoneæ.

- AA. Male and female spikelets in separate inflorescences or in different parts of the same inflorescence and of different appearance; lemmas hyaline or membranous and thinner than the glumes.

19. Maydeæ.

I. BAMBUSEÆ.

Shrubs or trees, very rarely perennial herbs; culms erect or sometimes climbing, often tall, usually woody, rarely herbaceous, bearing sheaths with reduced blades; leaf-blades flat, usually linear or oblong-lanceolate, many-nerved, mostly with a petiole-like base and frequently articulated with the sheath; spikelets all alike, 1 to many-flowered, arranged in panicles, racemes, dense clusters, or

terminal heads; glumes usually 2 or sometimes more; lemmas resembling the glumes and exserted from them, awnless or rarely awned from the tip, 5- to many-nerved, herbaceous to coriaceous; paleas 2-keeled or keelless or suppressed; lodicules usually 3, rarely more or less; stamens 3, 6, or more, with the filaments free or more or less connate; styles mostly 2 or 3; fruit a nut, berry, or a caryopsis.

Key to the genera of *Bambuseæ*.

I. DENDROCALAMUS Nees.

Spikelets ovate or oblong; acute or obtuse, few- to many-flowered, with concealed rhachilla, which is scarcely articulate and often produced; lower florets imperfect, 1-2, reduced to the lemma; 2-3 florets hermaphrodite with lemma and palea; terminal floret rudimentary or absent; glumes 2-3, often gemmiparous, membranous or rigid, muticous or mucronate, the upper often with a ciliate keel; lemmas papyraceous or membranous, subulate or mucronate at the apex, sometimes spinescent, back glabrous, hirsute or silky, margins glabrous or ciliate, many-nerved; paleas narrow, obtuse, those of the lowest florets 2-keeled, ciliate on the keels, those of the terminal floret rounded on the back. *Lodicules* absent. *Stamens* 6: filaments free; anthers mucronate or with tufted hairs; ovary sub-globular or ovoid, hairy above; style filiform, hairy; stigmas 1-2-3, subulate, papillose. *Caryopsis* with a crustaceous pericarp.

Arborescent bamboos often of large size. Inflorescence a large compound panicle, the spikelets usually congested in groups along the nodes of the floriferous branches.

Key to the species of *Dendrocalamus*.

Spikelets in spinous, congested, spicate heads;	
leaves usually narrow. ..	1. <i>D. strictus</i> .
Spikelets in large, soft, congested heads.	
Spikelets acute, culm-sheaths very hairy.	
Heads large, dark coloured: leaf and	
culm-sheaths conspicuously fringed. ..	2. <i>D. sikkimensis</i> .
Heads small, pale; leaf sheaths naked;	
culm-sheaths little fringed. ..	3. <i>D. hookeri</i> .
Spikelets blunt, culm-sheaths glabrous or	
nearly so.	
Culm- and leaf-sheaths not fringed. ..	4. <i>D. hamiltonii</i> .
Culm- and leaf-sheaths long fringed. ..	5. <i>D. patellaris</i> .
Spikelets few, in small heads, many sterile.	
Spikelets long, ovate-acute. ..	6. <i>D. giganteus</i> .
Spikelets short, blunt; culm-sheaths long,	
thin. ..	7. <i>D. longispinus</i> .

1. *Dendrocalamus strictus* Nees, in Linnaea IX (1834) 476.

A deciduous, densely-tufted bamboo. *Culms* hollow in wet, solid in dry climates, 6-20 m. tall, 2·5-7·5 cm. in dia-

meter, glaucous-green when young, dull-green or yellowish when old; nodes somewhat swollen; internodes 30-45 cm. long. *Culm-sheaths* variable, 7.5-30 cm. long, covered on the back with golden-brown, stiff hairs, sometimes glabrous, striate, rounded at the top, very slightly auricled, ciliate on the margins; imperfect blade triangular, subulate, hairy on both sides; ligule narrow. *Leaves* linear-lanceolate, 2.5-2.5 cm. long, 5 mm.-3 cm. broad, rounded at the base into a short petiole, terminating above in a sharply acuminate, twisted point, rough and often hairy above, softly hairy below, scabrous on the margins; leaf-sheaths striate, hairy, ending in a prominent callus and short auricle with a few, wavy, deciduous cilia; ligule narrow.

Inflorescence a large branching panicle of large, dense, glabrous, spaced heads; rhachis rounded, smooth. *Spikelets* spinescent, usually hairy, the fertile mixed with many smaller, sterile ones, 7.5-12.5 mm. long, with 2-3 fertile florets. *Glumes* 2 or more, ovate, spinescent, many-nerved; lemmas ovate, ending in a sharp spine surrounded by ciliate tufts of hair; palea ovate or obovate, emarginate, lower 2-keeled, ciliate on the keels, uppermost not keeled, often nearly glabrous, 6-8-nerved. *Stamens* long exserted; anthers yellow, shortly apiculate. *Ovary* turbinate, stalked, hairy above; style long, ending in a purple feathery stigma. *Caryopsis* brown shining, ovoid to sub-globose, 7.5 mm. long, beaked.

Cultivated in the plains.

2. *Dendrocalamus sikkimensis* Gamble, in Hooker Ic. Pl. t. 1770.

A large bamboo with caespitose stems and few culms. *Culms* 17-22 m., bare at the base, branchy at the top, 12-18 cm. in diameter, dark green in colour; internodes up to 45 cm. long, rough. *Culm-sheaths* 36 cm. long by 30 cm. broad, densely covered with golden-brown hairs; imperfect blade lanceolate, often as long as the sheath, recurved, decurrent into two auricles fringed with long, curved, pale bristles; ligule 5 mm. wide, sharply serrate. *Leaves* variable in size; those of the ordinary branches 15-25 cm. long by 36-50 mm. wide, oblong-lanceolate, unequal at the base, tapering to a

twisted point, shortly petiolate, thick, smooth above strigosely hirsute and rough below, margins rough; those of young shoots up to 30 cm. long by 7·5 cm. broad, elliptic-acuminate; leaf sheaths smooth, glabrous, furnished at the edges with falcate, hairy auricles fringed with stiff bristles; ligule short, hairy, fimbriate.

Inflorescence a large panicle with stiff nodose branches, bearing large, red-brown, globose heads usually 5 cm. apart and 3·75 cm. in diameter; rhachis dull brown, sparsely pubescent. Spikelets lanceolate, often rounded, 13-19 mm. long. Glumes 3-4, empty, broadly ovate rounded with ciliate keels. Hermaphrodite florets 2-3; lemmas ovate-acute, glabrous mucronate, ciliate; palea of the lowest floret 2-keeled, densely hairy on the keels, many-nerved, shortly bifid; upper floret sterile and reduced to a chaffy scale. Stamens six. Ovary sub-globular, hairy, with a short, thick, hairy style and club-shaped hairy stigma. Caryopsis obovate, depressed, apiculate, shining above with a few hairs.

Very common in the NAGA HILLS and also in the GARO HILLS.

3. *Dendrocalamus hookeri* Munro, in Trans. Linn. Soc. XXVI (1868) 151.

A large bamboo with caespitose stems and long curving branches. Culms 15-20 m. tall, often naked at the base, 10-15 cm. in diameter; internodes 40-50 cm. long, the lower sometimes rough, hairy. Culm-sheaths very broad at the base, narrower on the young shoots and on the upper branches, covered on the outside with dense, black or brown hairs, glabrous inside, furnished with small, rounded auricles covered with long stiff cilia, ciliate on the edges; imperfect blade rounded at the base, triangular or long-cuspidate, 7·5-17 cm. long, hairy at the top; ligule glabrous. Leaves large, oblong-lanceolate, acuminate, ending in a twisted point, rounded at the base, shortly petioled, smooth above, rough below, hairy towards the base, with scabrid margins; median nerve brilliant yellow; sheaths striate, hairy at the base; ligule glabrous.

Inflorescence a large, compound panicle bearing at intervals of 5-7·5 cm. dense glabrous heads of spikelets, 2·5 cm.

in diameter; rhachis dull grey-green, striate, somewhat hirsute. *Spikelets* 8-10 mm. long, by 2·5 mm. broad, ovate, acute, slightly pubescent, with 2-3 fertile flowers. *Glumes* 2, ovate-obtuse; lower lemma ovate-acute; upper many-nerved, nerves anastomosing; palea acute, 2-keeled, hairy on the keels; upper palea hardly keeled, ciliate at the top. *Stamens* 6, hardly exserted; anthers long, ending in a penicillate point. *Ovary* narrowly ovoid, acuminate, hairy, surmounted by a hairy style ending in a twisted plumose stigma. *Caryopsis* hairy at the base.

NAGA HILLS and KHASI HILLS; very common.

4. *Dendrocalamus hamiltonii* Nees et Arn. ex Munro, in Trans. Linn Soc. XXVI (1868) 151. Local names :—*Kakua*, Assam; *Pecha*, Bengal.

A large bamboo with caespitose culms, sometimes growing tall and erect, but more often sending out its stems at an angle or curved downwards. *Culms* large, 12-20 m. or up to 25 m. tall, usually naked below, much branched above; 10-18·5 cm. in diameter, greyish-white when young with dense appressed pubescence, dull green when old; nodes marked with root scars; internodes 30-50 cm. long, wall 1·25 cm. thick. *Culm-sheaths* long and stiff, variable in size, those of the lower part of large culms 35-45 cm. long, about 20 cm. broad, glabrous, shining within, rough, glabrous or with scanty patches of stiff brown hairs without, truncate at the top; imperfect blade about 3/4 the top of the sheath, broad, often 30 cm. long, narrow, ovate-lanceolate, sides incurved, glabrous without, closely covered with thick, black, sharp hairs within at the base; ligule smooth, entire. *Leaves* variable, small on side branches, but on new shoots reaching 37·5 cm. long 3·75 cm. broad, rounded at the base into a short thick petiole, broadly lanceolate, ending in an acuminate, scabrous, twisted point, smooth above, rough beneath, finely serrate on the margins; leaf-sheaths covered with white, appressed, stiff hairs, glabrous above, shining on the callus, somewhat keeled; ligule long, oblique truncate and jagged.

Inflorescence a huge, much-branched panicle with many whorls of branches, bearing half-vorticillate semi-globular

heads of purple flowers, supported by round scarious bracts; rhachis joints 2·5 cm. or less long, thick, fistular, scabrous and white pruinose; heads variable, 1·75-3·25 cm. in diameter. *Spikelets* purple, ovoid, depressed, 10 mm. long, glabrous. *Glumes* usually two, short, rounded, nerved; lemmas broad, orbicular, somewhat recurved, ciliate on the edges; paleas of lower flowers, 2-keeled, ciliate on the keels and bifid at the acute apex, many-nerved. *Stamens* exserted, pendulous; anthers purple, the connective produced into a long, black, hairy, twisted point. *Ovary* sub-orbicular, hairy; style long hairy; stigmas 3, plumose. *Caryopsis* broadly ovoid, beaked, glabrous or hairy above.

The commonest bamboo in the ASSAM VALLEY where it is in great demand for constructing temporary huts, basket and mat work etc. Also occurs in the KHASI HILLS and the SURMA VALLEY.

5. *Dendrocalamus patellaris* Gamble, Bamb. Brit. Ind. (1896) 86.

A rather soft, evergreen, caespitose bamboo. *Culms* 7-10 m. tall, 2·5-3·75 cm. in diameter, dull green, striate; nodes marked by a projecting, softly hairy ring; internodes 30-45 cm. long, whitish below the nodes; walls thin. *Culm-sheaths* long persistent, 25-30 cm. long, 7·5 cm. broad at the base, sparsely covered with appressed, brown, stiff hairs outside, glabrous within, attenuate at the top; margins membranous, lacinate; imperfect blade lanceolate, 15 cm. long, usually recurved; ligule long, fimbriate. *Leaves* variable, 20-40 cm. long by 2·5-10 cm. broad, unequal at the base, shortly petioled, terminating above in a twisted scabrous point, smooth above, rough below, scaberulous on the margins; leaf-sheaths striate, keeled, fringed on the margins; ligule very long, long fimbriate.

Inflorescence a huge compound panicle with spicate branches bearing distant distichous heads, heads 1·25-2·5 cm. in diameter, supported by hard shining bracts, many-spicate; rhachis dull greenish brown, rough, fistular. *Spikelets* dark brown, depressed, 10 mm. long. *Empty* glumes 1 or 2, many-nerved, membranous; florets 2-3, usually all fertile; lemmas orbicular, cuspidate, ciliate on the edges

and densely tomentose within, 9-11-nerved; palea much shorter, ovate-lanceolate, ciliate on the keels, 2-nerved between the keels, densely tomentose within; rhachilla prolonged, bristle-like. Lodicules 0 or 2, narrow linear-lanceolate, long ciliate. *Stamens* exserted; anthers purple, tip conical, hairy, apiculate. *Ovary* broadly ovate, hairy above; stigmas 3, short, plumose. *Caryopsis* rounded, shining, hairy above.

Common in the AKA HILLS at 5,000 ft. also in the NAGA HILLS about Kohima and Wokha.

6. Dendrocalamus giganteus Munro, in Trans. Linn. Soc. XXVI (1868) 150.

The largest of the bamboos, densely caespitose. *Culms* over 30 m. tall, 15-25 cm. in diameter, often naked at the base, branchy above; nodes hairy; internodes 37-40 cm. long, covered with white, waxy scurf when young. *Culm-sheaths* as broad at the base as at the summit, 25-50 cm. long; glabrous within, clothed without with golden or brown hairs, or glabrescent but rough, caducous; imperfect limb lanceolate, 15-35 cm. long, often recurved, decurrent into two narrow, wavy auricles. *Leaves* large, broadly-lanceolate, rounded at the base, cuspidate-acuminate, ending in a twisted point, 30-50 cm. long, 10-11 mm. broad, at first hairy, afterward glabrous; sheaths striate, glabrescent, hairy at the throat, with two lateral small auricles; ligule long.

Inflorescence a large panicle with long, slender, curved branches, bearing lax heads of few spikelets, sometimes leafy at the top; heads of spikelets up to 2.5 cm. in diameter. *Spikelets* 12-20 mm. long, ovate-acute, many-flowered, the lowest 2-3 florets reduced to the lemma, the next 2-4 with lemma and palea, sometimes female with more or less aborted stamens, the next 1-2 hermaphrodite the terminal rudimentary. *Glumes* ovate, mucronate, striate; lemma of the female flowers convex on the back, mucronate, many-nerved, clothed with appressed hairs, those of the hermaphrodite flowers flat on the back, shortly acute, spiny; paleas hairy dorsally, acute or cuspidate at the top, 2-keeled, keels long-fimbriate. *Stamens* 6; anthers acuminate-mucronate at the top. *Ovary* long-rostrate; style

simple or bifid. *Caryopsis* oblong, obtuse, 3 mm. long, hairy on the top.

Cultivated in the plains of ASSAM.

7. Dendrocalamus longispathus Kurz, Forst. Flor. Burm. II (1877) 561.

A large caespitose bamboo. *Culms* 20 m. tall, naked at the base, leafy above, glaucous or white when young, then turning yellow or yellowish green; internodes 25-60 cm. long, 7.5-10 cm. in diameter. *Culm-sheaths* papyraceous, 35-50 cm. long, 12-17 cm. broad, covered on the back with dense, stiff, appressed brown or black hairs, sides parallel almost to the top; imperfect limb lanceolate-acuminate, recurved, 30-45 cm. long, 25-36 mm. broad, densely hairy on the back; ligule toothed or fimbriate. *Leaves* oblong-lanceolate or linear-lanceolate, acuminate, shortly petioled, glabrous above, rough and glabrescent below, scabrid on the margins; median nerve yellow; sheaths smooth, glabrous, with 2 small auricles; ligule narrow, fringed.

Inflorescence a large panicle or of interrupted spicate clusters of spikelets situated at the nodes of long sinuate branches, bracteolate at the base. *Spikelets* few in each head, few-to many-flowered. *Glumes* 2-3, obovate, blunt; joints of rhachilla short; florets 2-3, fertile; lemmas obovate, rounded, obtuse or truncate, cucullate, many-nerved, ciliate on the margins; palea ovate-truncate, feebly 2-keeled, finely pubescent, with 2 intracarinal nerves. *Stamens* short; anthers yellow, ending in a blackish mucro. *Ovary* broadly ovoid, sometimes acute. *Style* long, hairy, terminating in a short hairy stigma. *Caryopsis* ovoid, crowned by the persistent base of the style.

Very common in SYLHET.

2. PSEUDOSTACHYUM Munro.

Spikelets small, 1-flowered; rhachilla produced ending in a terminal imperfect floret. *Glumes* usually only one, broad, mucronate; lemma similar to the glume; palea much convolute, 2-keeled; lodicules 3-5, persistent. *Stamens* 6; anthers apiculate; ovary rigid; style glabrous; stigmas 2;

caryopsis glabrous, depressed-globose; pericarp crustaceous.

A large shrubby bamboo with single culms from a creeping rhizome; leaves large, glabrous. Inflorescence a large leafy panicle of drooping bracteate spikes; rhachis wiry.

Pseudostachyum polymorphum Munro, in Trans. Linn. Soc. XXVI (1868) 142.

A large shrubby bamboo with single culms from a long creeping, jointed rhizome. Culms 17 m. tall, thick-walled, smooth; nodes not swollen; internodes 22 cm. long, 35 mm. in diameter, glaucous at first, afterwards dark green. Culm-sheaths shorter than the internodes, triangular truncate in outline, very shortly auricled with a tuft of short bristles; imperfect blade long-acuminata on the young culms; short, obscure triangular on the others, striate and furnished with purplish transverse nerves: ligule short, narrowly dentate. Leaves oblong-lanceolate, unequally rounded at the base into a short petiole, attenuate at the top into a long twisted point, smooth on both surface, scabrid on one margin; leaf-sheaths faintly white-pubescent, glabrescent; ligule short.

Inflorescence a very large leafy panicle, composed of branches fascicled at the nodes, pendulous or curved. Spikelets small, 5 mm. long, with 1 fertile floret; rhachilla produced bearing glumes or an incomplete floret. Glume one, broad mucronate, 7-nerved; lemma similar to the glume, finely ciliate above; palea thin, much convolute, 2-keeled, ciliate on the keels. Lodicles 3-5, usually 4, large, acute, rounded, or truncate at the apex, ciliate, persistent. Stamens 6, free; filaments short; anthers apiculate. Ovary narrow, linear-oblong, ending in a rigid style with 2 hairy stigmas. Caryopsis globose-depressed, surmounted by the base of the style; pericarp crustaceous. The inflorescence is very often diseased.

This bamboo is common in the ASSAM VALLEY especially at the foot of the NAGA HILLS.

3. TEINOSTACHYUM Munro.

Spikelets many-flowered, cylindrical, long-attenuate at the top, 25-75 mm. long, with an articulate rhachilla which if often visible, the lower 1-2, and the upper 2-4 florets incomplete, sterile, of one lemma only. Centre florets, 3-5,

hermaphrodite, with lemma and palea. *Lemma* overlapping at the base, broadest at the middle, attenuate towards the summit, many-nerved; palea 2-keeled, ciliate on the keels. *Lodicules* 3, many-nerved, sometimes concave at the base. *Stamens* six, filaments free; anthers obtuse. *Ovary* very long, attenuate at the top. *Fruit* bacciform, rostrate with a crustaceous pericarp.

Shrubby or arborescent bamboo. *Culms* thin, straight below, drooping above. *Inflorescence* a spicate panicle on leaf-bearing branches, the spikelets in bracteate verticils.

***Teinostachyum griffithii Munro*, in Trans. Linn. Soc. XXVI (1868) 143.**

A straggling or sub-scandent bamboo. *Culms* erect, arching, 8-16 m. long, verticillately branched from the nodes; internodes 45-65 cm. long, scabrid at the top; walls thin. *Culm-sheaths* 15 cm. and longer, 36 mm. broad, glabrous and shining at the base, covered with appressed white hairs, ciliate on the margins, strongly convolute; imperfect blade 7.5-10 cm. long, reflexed, ovate-acuminate, rounded at the base and prolonged into a large rounded auricle at either side, with long, curved, reflexed bristles on the auricle and base, densely white-shaggy inside, transverse nerves conspicuous; ligule short, pubescent. *Leaves* oblong-lanceolate, 15-25 cm. long, 17-36 mm. broad, rounded at the base into a strong petiole, glaucous below, terminating above in a scabrous, subulate point, scabrid on the margins, glabrous except below and at the base; sheaths striate, keeled, ciliate on the margins, glabrous or covered with appressed pubescence, with two fringed auricles at the throat; ligule short, ciliate.

Inflorescence a leafy (or leafless) panicle bearing at the verticils short spikes or single spikelets, often long, whip-like, with few spikelets on a filiform rhachis. *Spikelets* very narrow, linear, 5-7.5 cm. long, often pedicelled, with 3-5 hermaphrodite florets, with 1 or more sterile both above and below; rhachilla smooth, jointed, swollen at the joints. *Glumes* 1 or 2, 7.5-10 mm. long, narrow striate, ovate-micronate; lemmas 1.25 cm. long, ovate-acute, mucronate, 9-11-nerved, pubescent, palea somewhat longer, 2-keeled, the keels

edged half way down with a wavy fringe, ciliate near the tip, 4-nerved on either side. *Lodicules* ovate-lanceolate, concave, equal, quite glabrous, 7-9-nerved. *Stamens* exserted; anthers yellow, blunt or emarginate. *Ovary* stipitate, glabrous, ovate, narrowed into a triquetrous beak forming the style, with 2 or 3 white or purplish stigmas. *Grain* obliquely ovoid, glossy, tapering at both ends, ending in a stiff beak.

SIBSAGAR, LAKHIMPUR, KHASI and NAGA HILLS.

4. CEPHALOSTACHYUM Munro.

Spikelets in groups on the branches of the panicle; sterile spikelets often numerous, the fertile 2-flowered, the lower floret with lemma and palea, the upper rudimentary at the top of the prolongation of the rhachilla; glumes 2-4, broad, often long acuminate, sometimes gemmiparous, many-nerved, frequently hairy on the back; lemma of the fertile floret membranous, convolute, acuminate, subulate, often with a short awn; palea convolute, with two approximate keels, often 2-mucronate at the top; nerves often anastomosing; lodicules 3, membranous-hyaline, nerved; stamens 6; anthers long; filaments free; ovary stipitate, ovoid; style long, thickened, rigid; stigmas 2-3, short, plumose. *Caryopsis* often rostrate, obovoid, glabrous.

Erect or shrubby bamboos, often climbing. *Culms* slender, stiff; culm-sheaths auricled. *Inflorescence* a terminal globose head, or a panicle of heads with spreading branchlets; heads bracteate, the fertile spikelets usually mixed with many imperfect ones or with empty glumes.

Key to the species of *Cephalostachyum*.

Spikelets in single, terminal, globose heads.

Heads not more than 3.75 cm. in diameter;
leaves rather small.

Palea entire at the apex, anthers blunt. . . . 1. *C. capitatum*.

Palea bifid, anthers apiculate. . . . 2. *C. pallidum*.

Heads more than 3.75 cm. in diameter;
leaves large.

Culm- and leaf-sheaths not fringed; palea
undivided. 3. *C. latifolium*.

Culm- and leaf-sheaths fringed; palea
bifid. 4. *C. fuchsianum*.

Spikelets in heads in interrupted, paniculate spikes. 5. *C. pergracile*.

1. *Cephalostachyum capitatum* Munro, in Trans. Linn. Soc. XXVI (1868) 139.

Culms semi-scandent, 4-10 m. long, yellow, pendulous over the branches of trees; nodes not prominent; internodes long, often 1 m., 24-30 mm. in diameter with thick walls. Culm-sheaths somewhat thin, papyraceous towards the top on young culms, those on the lower nodes thickened, 15-30 cm. long, 50-75 mm. wide, covered on the back with an adpressed, pale brown pubescence, truncate at the top of long sheaths, on the lower concave, with a rounded sinus; imperfect blade long, erect or recurved, covered with white hairs, rounded at the base and decurrent into two small auricles which are sometimes fringed; ligule narrow, toothed. Leaves pale-green, whitish beneath, ovate-lanceolate, rounded unequally at the base into a short petiole, prolonged at the top into a twisted, scabrid, setaceous tip, 10-20 cm. long, 25-50 mm. wide, glabrous on both surfaces, scabrid on the margins; sheaths glabrous, shining, fimbriate in the throat with long caducous hairs; ligule short.

Inflorescence a dense, globular, terminal or axillary, brownish head, 25-40 mm. in diameter. Sterile spikelets numerous, hidden by shining, scarious scales which are often keeled on the back; fertile spikelets 15-20 mm. long, few, with 1-3 sterile florets at the base. Glumes 2, ovate, glabrous at the top or slightly pubescent, with anastomosing nerves, tip ending in a scabrous awn. Lemma of the fertile floret similar in shape but with a shorter awn; palea as long as the lemma, convolute, thin, 2-keeled, with approximate keels, hairy between the keels, mucronate. Lodicules 3, oblong-lanceolate, nerved, obtuse, attenuate and ciliate at the top. Stamens 6; anthers emarginate at the top. Ovary ovoid, furrowed, glabrous, attenuate into a twisted style, which ends in two hairy stigmas. Caryopsis chestnut, smooth, shining, depressed, surmounted by the remains of the style.

KHASI, JAINTIA, NAGA and AKA HILLS at altitudes between 2,000 and 8,000 ft.

2. Cephalostachyum pallidum Munro, in Trans. Linn. Soc. XXVI (1868) 140.

A shrubby bamboo. *Culms* not more than 2 m. tall (fide E.G. Camus). *Culm-sheaths* not known. *Leaves* pale green, ovate-lanceolate, unequally rounded at the base into a petiole 5 mm. long, which is often wrinkled; suddenly narrowed above into a scabrous, subulate point ending in a long hair-like tip, 2·5-12·5 cm. long, 1·25-2·5 cm. broad, glabrous on both surfaces or minutely pubescent below, rough on the margins, which are somewhat cartilaginous; leaf-sheaths striate, ciliate on the margins, ending in a short rounded auricle furnished with a few, very early deciduous cilia; ligule long, sometimes ciliate.

Inflorescence a pale, terminal head about 2·5 cm. in diameter, supported by a leaf and broad, rounded, glabrous, sheath-like bracts, and consisting of many long, aristate, empty glumes or sterile spikelets, with a few exserted fertile spikelets. *Spikelets* 17·5-20 mm. long; empty glumes sessile, or with a few empty bracts at the base, 12·5-15 mm. long, ovate, concave, ending in an awn 5 mm. long, many-nerved, sometimes pubescent on the back below the awn. *Lemma* similar but with a shorter awn; palea as long as the lemma thinner in texture, many-nerved, tessellate, closely 2-keeled, bifid-mucronate at the apex, hairy below the keels and at the tip; rhachilla produced, short. *Lodicules* lanceolate or spatulate-lanceolate, 3-5-nerved, minutely papillose, pubescent, ciliate at the tip. *Stamens* exserted; filaments long; anthers long apiculate. *Ovary* ovoid-lanceolate; style conical; stigmas 2, hairy. *Caryopsis* chestnut, glabrous, ovoid-globose.

KHASI HILLS, MISHMI HILLS, PATKAI RANGE and MANIPUR, ascending to 5,000 ft.

3. Cephalostachyum latifolium Munro, in Trans. Linn. Soc. XXVI (1868) 140.

A small scrambling bamboo. *Culms* 2-3 m. tall, dark green in colour, whitish below the nodes. *Culm sheaths* thin, papyraceous, straw-coloured, 15-22 cm. long, 50-75 mm. wide, not attenuate but rounded at the top into a concave sinus,

furnished with 2 small, triangular, erect auricles; imperfect blade 10-12.5 cm. long, 8-12 mm. broad, acuminate-subulate, somewhat attenuate at the base; ligule broad. Leaves very broad, ovate or ovate-lanceolate, oblique at the base or rounded and abruptly narrowed into a short petiole, ending above in a scabrid, setaceous point. Sheaths striate, ciliate, ending in an emarginate callus, rounded at the top; ligule long.

Inflorescence composed of groups of spikelets in globular heads 5 cm. in diameter, at the tips of leafy branches; some spikelets sterile, some fertile seated in the axils of broad keeled bracts. Spikelets 1-flowered, acuminate, long-aristate, 12-20 mm. long; glumes 14 mm. long, ovate-lanceolate, long-aristate, glabrous except on the keel, striate, somewhat keeled. Lemma lanceolate-acuminate, with a shorter awl and anastomosing nerves; palea membranous, tessellately nerved, rounded at the summit, convolute. Lodicules ovate-lanceolate or spatulate, ciliate, 3-nerved, pubescent. Stamens exserted; filaments long; anthers mucronate at the apex. Ovary ovoid, attenuate into a long flattened style, with 2 short plumose stigmas. Grain blackish-brown, shining, broadly ovoid, grooved, terminated by the persistent base of the style surrounded by the persistent lemma palea and lodicules.

NAGA HILLS and MANIPUR, 7,000 ft.

**4. *Cephalostachyum fuchsianum* Gamble, Bamb.
Brit. India (1896) 107.**

A medium-sized, arborescent, semi-scandent bamboo. Culms thin walled, soft, pale, verticillately branched from the nodes. Culm-sheaths thin, striate and reticulately veined at the edges, sides nearly parallel, rounded at the top on each side into a deep (often 2.5 cm. deep and 1.25 broad at the bottom) concave, long-bristly-fringed sinus, 30 cm. long by 10 cm. broad, clothed on the back with appressed light brown pubescence; imperfect blade inserted at the base of the sinus, reflexed, subulate, 15-20 cm. long, 17.5-20 mm. broad, closely pubescent below; ligule small. Leaves large ovate-lanceolate, angled or rounded at the base with a long (12.5-15 mm.) petiole, cuspidately acuminate, ending in a scabrous twisted point, glabrous on both surfaces, scabrous on the margins;

leaf-sheath soft, dark green, striate, thickly long-ciliate on the edges ending in a rounded callus and produced at the top into an elongated auricle thickly clothed with stiff, white bristles; ligule moderately long, ciliate.

Inflorescence a dense, globular, terminal head, 3-25 cm. in diameter, or else an elongated, densely packed, terminal, congested spike of superposed heads, consisting of many, fertile spikelets among empty, aristate bracts or sterile, smaller spikelets. *Spikelets* elongate, 2-2.5 cm. long, glabrous. *Glumes* 15-17.5 mm. long, ovate at the base, long-scabrous-aristate above, glabrous, striate, 17-19-nerved; lemmas similar, but more elongate and more shortly aristate, 21-23-nerved, tessellate; palea rather longer than the lemma, thin, ovate-lanceolate, bifid at the apex, mucronate-tipped, pubescent, 2-keeled, keels close together, 5-6-nerved; rhachilla produced, short. *Lodicules* linear-lanceolate or spatulate, blunt, 3-5-nerved, minutely ciliate above and papillose on the sides. *Stamens* long-exserted, pendulous; anthers sharply apiculate or forked at the tip. *Ovary* narrowly ellipsoid; style thick; stigmas 2, short. *Caryopsis* chestnut-brown.

DAPHLA HILLS; NAGA HILLS near Birema. Flowered in the Naga Hills in 1935. The caryopses were produced in great numbers and were collected in large quantities by the Kacha Nagas and used as food.

5. *Cephalostachyum pergracile* Munro, in Trans. Linn. Soc. XXVI(1868) 141.

A deciduous, arborescent, tufted bamboo. *Culms* erect, glaucous-green, somewhat whitish-puberulous below the nodes, 10-13 m. tall, 5-7.5 cm. in diameter; nodes scarcely thickened; internodes 30-45 cm. long, walls very thin. *Culm-sheaths* much shorter than the internodes, 10-15 cm. long, 15-20 cm. broad, densely covered with black, stiff, deciduous hairs, afterward polished, chesnut-brown; imperfect blade 5 cm. long, ovate, cordate, cuspidate, densely hairy within, decurrent into a wavy fringe bordering the top of the sheath and ending on either side in a rounded auricle; both fringe and auricle edged with long, stiff, curved, white bristles; ligule very narrow entire. *Leaves* variable, linear-lanceolate, 15-35

cm. long, by 2·5-3·25 cm. wide, or even 6·25 cm., thin, rounded or cuneate at the base into a short petiole, terminating above in a subulate, scabrous, acuminate point, rough on the margins and on the surfaces, glaucous beneath; leaf-sheaths glabrous, faintly striate, ending in a small, ciliate callus, auricled at the mouth with a few, early-caducous cilia; ligule very narrow, entire.

Inflorescence a large panicle with verticils of long drooping, filiform spikes bearing distant broad heads of spikelets supported by small, chaffy, sheathing bracts; rachis very slender, wiry, 3·25-5 cm. between the clusters. Spikelets in bracteate clusters, 1·25-1·75 cm. long, without glumes, but 1-2 sterile florets, followed by a fertile floret, ending in a terminal sterile floret or filiform, produced-rachilla. *Lemma* 1·25-1·75 cm. long, ovate-lanceolate, many-nerved, densely pale-hairy, long-mucronate; palea as long, 2-keeled, the keels close together, ciliate, apex deeply bifid, mucronate. *Lodicules* 2, narrow, lanceolate, obtuse and ciliate at the tip 3-5-nerved, persistent. *Anthers* purple. *Ovary* smooth, sub-globular; style 3-cornered; stigmas 2-3, stout, recurved. *Caryopsis* obovate-oblong, shining, 1·25 cm. long, furrowed on one side, ending in a beak 1·25 cm. long.

Plains of ASSAM, SIBSAGAR, LAKHIMPUR. Flowered in Dibrugarh in 1936.

5. NEOHOUEAU A. Camus.

Inflorescence an elongate panicle. *Fertile* spikelets 1-flowered; glumes 3-4, mucronate, often gemmiparous; lemma involute, mucronate, subaristate; palea elongate, involute, without keels, 2-aristate at the top; lodicules 0 or very small. *Stamens* 6, filaments connate; anthers obtuse at the apex. *Ovary* oblong; style long; stigmas 3, exserted.

Medium-sized bamboos with culms growing in large tufts, often somewhat scandent, unarmed.

Key to the species of *Neohouzeaua*.

Branches erect; panicle spiciform.	..	1. <i>N. dullooa</i> .
Panicle of spaced heads.	..	2. <i>N. helferi</i> .

1. *Neohouzeaua dullooa A. Camus*, in Bull. Mus. Paris (1922) 100. Syn. *Teinostachyum dullooa Gamble*, Bamb. Brit. Ind. (1896) 101.

A middle-sized bamboo. *Culms* erect, 4-9 m. tall, whitish below the nodes; nodes hardly prominent; internodes 4-1 m. long with thin walls. *Culm-sheaths* varying in size according to the internodes, from 15-30 cm. long and 10 cm. broad, to 30 cm. long and 25 cm. broad, striate, with scattered white hairs, prominent above, rounded at the top, concavely truncate and loose-fringed with stiff bristles; limb narrow, subulate, recurved, hairy within, 7.5-15-cm. long, 8-17 mm. wide at the base; ligule prominent, long-fimbriate. *Leaves* variable, oblong-lanceolate, acuminate, rounded, often unequally, at the base into a short petiole, terminating in a twisted, subulate point, rough on the upper surface, minutely softly pubescent beneath of glabrescent, rough on the margins; sheaths striate, ciliate on the margins; callus ciliate or glabrous; ligule long, hairy.

Inflorescence a panicle with spiciform branches, furnished with long, truncate bracts, with softly hairy, imperfect, caducous limbs. *Spikelets* rather close, few in number, 1.25-2.5 cm. long, slender, cylindrical-fusiform, acute, softly hairy with one fertile floret; glumes 2-4, ovate-acute, long-mucronate, subaristate, the upper resembling an empty lemma. *Fertile floret*, lemma 12-14 mm. long, convolute, acute, subaristate, many-nerved, pubescent at the top; palea convolute, lanceolate, keelless or very obscurely keeled at the top, many-nerved, hairy at the top, terminating in two awns, which are scabrid and 1.1-1.5 mm. long. *Filaments* connate; anthers obtuse. *Ovary* glabrous; style forming a beak 12-14 mm. long; stigmas short.

Common in both VALLEYS.

2. *Neohouzeaua helferi Gamble*, in Kew Bull. (1923) 91. Syn. *Teinostachyum helferi Gamble*, Bamb. Brit. Ind. (1896) 102.

An evergreen, tufted bamboo forming large impenetrable thickets. *Culms* 6-12 m. tall, 2.4-3.6 cm. in diameter; spreading in all directions; internodes greyish to green in

youth, walls thin; nodes somewhat inflated, whitish; culm-sheaths 20-25 cm. long, persistent, thick, brittle when young, bearing a few appressed bristles which leave a scar when they fall, rough towards the base, truncate at the top; imperfect blade nearly as long as the sheath, recurved, lanceolate, acuminate, glabrous or shortly hispid, rounded at the base and decurrent as a very narrow long-fringed band at the top of the sheath; ligule narrow, fringed with stiff hairs. Leaves variable, oblong-lanceolate, 15-45 cm. long, 2·5-7·5 cm. broad, unequal at the base, shortly petiole, cuspidate-acuminate, ending in a long, scabrous twisted point, margins rough, glabrous and glaucous beneath; leaf-sheaths glabrous, smooth, striate, ending in a smooth callus and a short long-fringed auricle; ligule narrow, fringed.

Distant heads of spikelets often up to 5 cm. in diameter, usually less. Spikelets paired; glumes 2, 5 and 8 mm. long; lemma 12-25 mm. long; palea convolute. Stamens 6; filaments connate. *Caryopsis* over 5 cm. long.

GARO, KHASI and JAINTIA HILLS, 3-4,000 ft.

6. DINOCHLOA Buse.

Spikelets minute, very numerous, in sub-globose sessile heads on short branchlets, 1-flowered; rhachilla short, inarticulate, not produced. *Empty glumes* 1-4, broad, very obtuse, muticous, gradually larger upwards. *Lemmas* similar; palea convolute, equal to, or larger than, the lemma, not keeled. *Lodicules* none. *Stamens* 6, free, short. *Ovary* ovoid, glabrous; style short. *Caryopsis* ovoid-acuminate.

Lofty climbing bamboos, with zigzag culms. *Culm-sheaths* thick, loosely-clasping, wrinkled at the base, where a broad leathery ring remains after the sheath falls. *Leaves* rather large, soft, tessellately nerved. *Inflorescence* a large, compound panicle of thin, spicate clusters of spikelets.

Key to the species of *Dinochloa*.

- | | |
|-------------------------------------------------|---------------------------------|
| Culm-sheaths leathery; pubescence golden-brown. | .. 1. <i>D. maclellandii</i> . |
| Culm-sheaths brittle; pubescence white. | .. 2. <i>D. compactiflora</i> . |

1. *Dinochloa maclellandii* (*Munro*) Kurz, in Journ. As. Soc. Beng. XLII (1873) 253.

An evergreen, lofty, often scandent bamboo. *Culms* up to 30 m. long, if climbing; shorter and straggling if growing unsupported, 2·5-5 cm. in diameter, zigzag-geniculate, covered by the persistent loose sheaths, grey-green, walls thin; nodes swollen; internodes 15-20 cm. long, often angled when young, scabrous with brown appressed pungent hairs. *Culm-sheaths* cylindrical, the base often dark, leathery persistent, 15-22·5 cm. long, 17·5-22·5 broad at the base, 5·7·5 cm. wide at the top, covered with densely appressed, golden-brown pubescence, ending above in a narrow dark glabrous margin edging the whole of the truncate top outside the base of the imperfect blade; imperfect blade lanceolate-acuminate, rounded at the base and decurrent on to the sheath, 15-30 cm. long, 2·5-6·25 cm. broad, recurved or spreading, glabrous outside, densely brown hairy within; ligule short, entire or faintly serrate. *Leaves* large to very large, broadly oblong-lanceolate, acuminate, unequal at the base, rounded into a short thick petiole up to 1·25 cm. long, ending in an acuminate, setaceous, scabrous, twisted tip; leaf-sheath striate, transversely veined, produced at the mouth into a naked, rounded auricle, keeled at the back, appressed hairy when young, afterwards glabrous; ligule often broad, entire or serrate.

Inflorescence unknown.

CACHAR and SYLHET.

2. *Dinochloa compactiflora* (Kurz) McClure, in Kew Bull. (1936) 251. Syn. *Melocalamus compactiflorus* Benth. in Journ. Linn. Soc. Bot. XIX (1882) 134. Syn. *Pseudostachyum compactiflorum* Kurz, in Jour. As. Soc. Beng. XLII (1873) 252.

An evergreen tufted arborescent bamboo. *Culms* greyish green, rough, scandent, spreading and arching, 5-8 m. and more tall, sometimes even up to 30 m. and climbing over tall trees, up to 2·5 cm. in diameter; nodes thickened; internodes 35-60 cm. long. *Culm-sheaths* persistent, hard, brittle, cylindrical, smooth or covered with long, white, appressed hairs, truncate at the mouth, dilated at the base,

about 15 cm. long by 7·5 cm. broad; imperfect blade as long as or longer than the sheath, recurved, long-acuminate, rounded at the base and then spreading out into a narrow, dark, reflexed, crescent shaped auricle, fringed with stiff bristles, hispidly hairy towards the base; ligule narrow, entire. *Leaves* large, oblong-lanceolate, rounded at the base into a short, hairy petiole, terminating in a subulate, acuminate, penicillate, scabrous, twisted point, scabrous on one margin, 15-25 cm. long by 2·5-5 cm broad; leaf-sheaths striate, appressed white hairy when young, glabrescent, somewhat keeled, truncate at the mouth, furnished with a lunate reflexed auricle fringed with stiff, early caducous bristles; ligule narrow, entire.

Inflorescence a large, compound, interrupted panicle of small, sub-globose heads, bearing several fertile and many sterile spikelets often leaf bearing; the rhachis very pubescent, flexuose, flattened on one side; heads 7·5-12·5 mm. in diameter. *Spikelets* very small, 2·5 mm. long, and as broad, glabrous, blunt or truncate, 2-cleft, with 2 fertile flowers and 1 empty terminal on a produced rhachilla. *Glumes* 2, broadly ovate, ventricose, very shortly mucronate; lemma similar, often ciliate on the edges; palea as long as the lemma, broadly boat shaped, shortly and bluntly 2-toothed, 2-keeled, ciliate on the keels and 4-5-nerved between. *Lodicules* 3, large, ovate, blunt, long ciliate. *Stamens* free; filaments short; anthers yellowish, bluntly acute at the tip. *Ovary* glabrous, ovoid-globose, surmounted by a short thick style; stigmas 2 or 3, short plumose. *Caryopsis* large, sub-globular, 2·5-3·75 cm. in diameter, summit depressed.

CACHAR and SYLHET plains. Used for basket work.

7. MELOCANNA Trinius.

Spikelets 2 to 3, fasciculate in bracts in the axils of the spikes, acuminate, with one fertile and one or more sterile florets. *Empty glumes* indefinite, acuminate, mucronate, striate. *Lemmas* similar to the empty glumes; palea similar, convolute, not keeled. *Lodicules* 2, narrow. *Stamens* 5 to 7; filaments free or irregularly joined. *Ovary* glabrous; style

elongate; stigmas 2 to 4, shortly hairy. *Caryopsis* very large, pea-shaped, long-beaked; pericarp very thick.

Arborescent bamboo, unarmed. *Culms* erect, distant, single from the ramifications of an underground rhizome. *Culm-sheaths* often persistent, brittle, short, with short auricles; imperfect blade very long. *Leaves* broad, petioled, smooth. *Inflorescence* a large compound panicle of spicate, secund spikelets.

Melocanna bambusoides *Trin. apud Spreng.*, Neue Entd. II (1821) 43.

Culms single, distant, green when young, straw-coloured when older, clothed with the persistent sheaths, unbranched till near the top, up to 20 m. tall; nodes marked by a thin ring; internodes smooth, 30-50 cm. long; walls thin. *Culm-sheaths* yellowish-green when young, yellow when old, brittle, striate, covered with whitish appressed hairs, 12.5-15 cm. long, 15-30 cm. broad at the base, straight for two-thirds of the way up then once or twice waved, cut off straight or concavely below the imperfect blade, the edges produced upwards into rounded often long-fringed auricles; imperfect blade up to 30 cm. long, recurved, subulate-acuminate, the base decurrent into a narrow strip along the top of the sheath, ligule very narrow, serrate. *Leaves* lanceolate or oblong-lanceolate with a long, scabrous, twisted point; rounded at the base into a 1.25 cm. long petiole, 15-35 cm. long, 2.5-3.25 or even 7.5 cm. broad, glabrous above, glaucous beneath and hairy when young, both edges finely ciliate, scabrous on one margin; leaf-sheaths glabrous, smooth, ending in a pointed auricle which bears 10-12 stiff, white, deciduous bristles; margin ciliate; ligule very short.

Inflorescence a large, compound panicle of one-sided, drooping, spicate branches bearing clusters of 3-4 spikelets in the axils of short, blunt, glabrous bracts. *Spikelets* about 1.25 cm. long, glabrous, spinous. *Glumes* 2-4, sometimes gemmiparous, striate, lanceolate, shortly mucronate; lemma similar, but thinner; palea glabrous, convolute, mucronate, acuminate, not keeled. *Lodicules* 2, narrow, linear-oblong, obtuse and erose-fimbriate at the top, 3-5-nerved. *Stamens*

free at the base or irregularly joined; anthers yellow, notched at the apex. *Ovary* ovoid; style elongate; stigmas 2-4, recurved, hairy. *Caryopsis* very large, 7-5-12.5 cm. long, obliquely ovoid, fleshy, beak curved; pericarp thick, fleshy.

Very common in the SURMA VALLEY where it is gregarious over very large areas.

8. BAMBUSA Schreber.

Spikelets many-flowered, rarely few-flowered, with imperfect florets at the base or apex. *Glumes* 1-3. *Lemmas* ovate-lanceolate, usually mucronate, many-nerved, usually glabrous, coriaceous-papyraceous; paleas 2-keeled, keels ciliate or not, tips mostly entire. *Lodicules* 3, membranous, obtuse, ciliate. *Stamens* 6; filaments free, often exserted; anthers narrow, tip obtuse or apiculate or penicillate. *Ovary* oblong or obovate, hairy at the apex; style short or long. *Caryopsis* oblong or linear-oblong, acute or obtuse, furrowed on one side; pericarp thin, adherent; embryo conspicuous.

Arborescent or shrubby, or rarely climbing bamboos, sometimes thorny! *Culms* from a thick rhizome, usually caespitose, occasionally stoloniferous. *Inflorescence* usually a large leafless compound panicle.

Key to the species of *Bambusa*.

Culms without spines.

Spikelets cylindric.

Spikelets in loose heads.

Arborescent.

Imperfect blade of culm-sheath triangular from a broad base.

Culm-sheaths with large auricles.

Palea ciliate on the keels.*

Anthers obtuse. 1. *B. tulda*.

Anthers apiculate. 2. *B. nutans*.

Anthers penicillate. 3. *B. teres*.

Palea not ciliate on the keels. 4. *B. polymorpha*.

Culm-sheaths with small auricles. 5. *B. pallida*.

Imperfect blade inflated, leaf-tips shaggy. 6. *B. khasiana*.

Shrubby. 7. *B. nana*.

Spikelets in dense heads, ovate. 8. *B. balcooa*.

Spikelets flattened.	..	..	9. <i>B. vulgaris</i> .
Culms with spines.	..	..	10. <i>B. arundinacea</i> .
Species with flowers not known.			
Culms scandent; leaves glabrous, leaf sheaths with long bristles.	..	..	11. <i>B. mastersii</i> .

1. *Bambusa tulda Roxb.*, Hort. Beng. (1814) 25.
Local names :—*Mirtinga* (Sylhet); *Wati* (Garo); *Wamuna*,
Wagi, *Nalbans*, *Deobans*, *Bijli* (Assam); *Tulda*, *Jowa*
(Beng.).

A tufted bamboo; culms reaching a height of 22 m., 5-10 cm. in diameter, hollow, smooth, green, sometimes striped with yellow. Lower branches leafless, rigid, horizontal. Culm-sheaths 15-22 cm. long, by 15-25 cm. broad, smooth or covered with appressed white or brown hairs; slightly attenuate upwards and rounded or triangularly truncate at the top; imperfect blade broadly triangular reniform or cordate, cuspidate, erect, hairy within, the base decurrent into rounded, large, long-fringed auricles, or a wavy narrow-fringed band along the upper edge of the sheath; ligule narrow, entire. Leaves linear-oblong or lanceolate, rounded or cordate at the base, 11-32 cm. long, 17-37 mm. broad; upper surface and margins rough; sheaths striate, glabrous, ending in a smooth callus and on oblong rounded auricle, from which spring long white bristles; ligule narrow.

Inflorescence variable, usually a gigantic, leafless panicle but sometimes very short; branches spicate, bearing interrupted clusters of few (1-5) usually fertile long spikelets. Spikelets cylindrical at first then a little compressed, 2.5-7.5 cm. long, 7-10-12-flowered, often hirsute at the top, 1-2 empty bracts at the base, than several glumes. Lower 1-2 and upper 2-3 florets imperfect, male or female. Central florets hermaphrodite; lemmas smooth, shining, acuminate, somewhat membranous at the base, 25 mm. long; palea a little shorter or equal to the lemma in length, 2-keeled, keel ciliate, 5-7-nerved between the keels; rhachilla clavate, flattened, glabrous except on the ciliate tip, articulate. Lodicules 3, 2 obtuse, the third lanceolate, hyaline, fimbriate. Stamens 6, rarely 3 by abortion, exserted, muticous or obtusely mucronate. Ovary stipitate, obovate, hairy on the top, short-

styled; *stigmas* 3, plumose. *Caryopsis* oblong or obovate, hirsute on the top.

Very common in the ASSAM VALLEY where it is much used for building and scaffolding, and for making mats and baskets.

2. Bambusa nutans Wallich apud Munro, in Trans. Linn. Soc. XXVI (1868) 92. Local names : *Peechli* Sylhet; *Jotia-makal*, *Deobans*, Assam; *Seringjai*, Khasi.

Very similar in habit to *B. tulda* Roxb. *Culms* green, smooth, not shining, white-ringed below the nodes, 7-14 m. tall, 4-8 cm. in diameter. *Internodes* 36-45 cm. long. *Culm-sheaths* 15-22 cm. long, covered on the back with appressed and scattered black hairs, the base bearing a ring of soft deciduous hairs; imperfect blade of the lower and upper sheaths 15-21.5 cm. long and very broad, that of central nodes shorter, acute, margins recurved, clothed within with appressed black hairs, decurrent into large waved auricles which bear long curved bristles; ligule short, dentate. *Leaves* linear-lancolate, 15-30 cm. long, 2.5-3.75 cm. broad, rounded or attenuate at the base into a short petiole; tip a twisted scabrid point; margins scabrous; secondary veins 7-10, intermediate 8-9, pellucid glands frequent; leaf sheaths striate, hairy when young, produced into a falcate auricle with a few long bristles; ligule long, obtuse hairy.

Inflorescence similar to that of *B. tulda*. *Spikelets* 2.6-5 cm. long with few fertile florets, densely verticillate, sterile spikelets many. *Rhachilla* long, visible, articulate. *Glumes* 2 or 3, hermaphrodite florets 3-5, followed by 2-3 imperfect florets at the top. *Lemma* of the hermaphrodite florets up to 2.7 cm. long, acute or mucronate, ovate, many-nerved, minutely hairy within: palea flattened, ovate, 2-keeled, the keels covered with long white hairs. *Lodicules* 3, broad, obtuse, long-fimbriate. *Stamens* 6; anthers long spiculate or narrowly penicillate at the summit. *Ovary* stipitate, obovate, pubescent, on the top. *Style* short, pubescent; *stigmas* 2-3, almost glabrous or plumose. *Caryopsis* oblong, obtuse, hairy on the top.

Without flowers it is extremely difficult to separate this bamboo from *B. tulda*. It is fairly common in the ASSAM VALLEY.

3. Bambusa teres Ham. ex Wall., Cat. 5026 B.

A densely caespitose bamboo. *Culms* up to 30 m. tall, dark green, smooth, 7.5 cm. in diameter; nodes ringed by the bases of the fallen sheaths; internodes 50 cm. long, walls 8-10 mm. thick. *Culm-sheaths* 20-25 cm. long, equally broad, nearly glabrous, hardly attenuate upwards, somewhat rounded on top; imperfect blade 10-15 cm. long, broad, triangular, cuspidate, appressed hairy beneath, rounded at the base, and then again decurrent in broad wavy auricles fringed with a few deciduous bristles; ligule narrow, white-hairy outside. *Leaves* oblong-lanceolate, 30-35 cm. long, 40-45 mm. wide, unequal at the base and attenuate into a short petiole, long acuminate, ending in a setaceous point, glabrous above, pubescent beneath; margins rough; leaf sheaths glabrous or slightly hairy, truncate at the mouth; ligule short.

Inflorescence a large compound panicle with spicate branches bearing groups of fertile and sterile spikelets with chaffy bracts. *Fertile* spikelets up to 5 cm. long, dull, 7-8-flowered, of which the upper two are often imperfect; rhachilla striate, often ciliate at the top. *Glumes* ovate, mucronate. *Lemmas* of the male spikelets many-nerved, long acuminate, tip occasionally foliaceous; palea ovate-acute, scaberulous, 5-6-nerved between the scabrid or ciliate keels, long hairy at the top. *Lodicules* many-nerved, long-fimbriate. *Anthers* narrow, penicillate. *Ovary* obovate, very hairy on top, beaked; style-short; stigmas 3, hairy, long.

DARRANG. The stems are stated to be of little value as they are readily attacked by insects.

4. Bambusa polymorpha Munro, in Trans. Linn. Soc. XXVI (1868) 98. Local names :—*Betua, Jama, Bengali.*

A tall, tufted bamboo. *Culms* 20-27 m. tall, usually evergreen, but occasionally losing their leaves during the dry season, unarmed, curving at the top; nodes prominent; internodes 7.5-15 cm. in diameter, 30-60 cm. long, greyish-green in colour, covered with a white scurf when young. *Culm-sheaths* thick, coriaceous, shining with a few hairs within,

covered on the back with a dense, white appressed pubescence, attenuate towards the top; imperfect blade sub-reniform, concave, cuspidate, rounded at the base and widening in a long auricled band, produced beyond it into two falcate auricles, the whole being fringed with long stiff bristles; ligule narrow, entire. *Leaves* thin, linear-lanceolate, attenuate or rounded at the base into a short petiole, long acuminate at the tip, 10-18 cm. long, 10-16 mm. broad, rough on the upper, hairy on the lower surface, margins seabrous; sheaths compressed, striate, hairy, ending in a callus and a minute auricle furnished with a few long deciduous bristles; ligule very short.

Inflorescence a much-branched panicle, with curving racemes of frequent heads, bearing few spikelets surrounded by brownish, glabrous, mucronate, chaffy bracts; rhachis smooth, the upper part covered with white appressed pubescence, wiry. *Spikelets* shining, often brownish, 10-12.5 mm. long, in lower heads 5-6, number gradually decreasing upwards, somewhat pedicellate and enclosed in a long, curved, glabrous bract. *Empty* glumes 1-3, ovate-mucronate, then 2-3 fertile flowers, then a terminal imperfect flower; rhachilla produced, long, flattened, glabrous; lemmas ovate-mucronate, many-nerved; paleas somewhat longer, lanceolate, acute at the top, keels not ciliate. *Lodicules* 3, sub-obicular, short-fimbriate, 3-5-nerved, one smaller than the other two. Anthers purple, obtuse, sometimes apiculate. *Ovary* obovate, hairy at the top; style with 3 short white-hairy stigmas. *Caryopsis* ovate, 5 mm. long, depressed, flattened on one side, hairy above, ending in a short hairy mucro.

Found in SYLHET.

5. ***Bambusa pallida* Munro**, in Trans. Linn. Soc. XXVI (1868) 97. Local names:—*Makal* Assam; *Burwal* Cachar.

A caespitose bamboo growing in thick clumps. *Culms* smooth, fistular, 12-20 m. tall, 5.4-7.5 cm. in diameter, olive-green in colour; internodes 50-80 cm. long, walls thin. *Culm-sheaths* 17.5-30 cm. long, by 25 cm. broad, straight-

truncate at the top, glabrous or covered with appressed white hairs when young; imperfect blade very long, usually longer than the sheath, up to 35 cm., triangular-acuminate from a broad base, furnished with small round auricles, the auricles and lower parts fringed with bristles, sparsely black-hairy without, glabrous or slightly hairy within; ligule very narrow. *Leaves* linear-lanceolate, 10-20 cm. long, 1-2 cm. broad, rounded at the base into a short petiole, ending in a subulate, twisted point; leaf-sheaths glabrous, striate, ending in a rounded, erect auricle with a few long bristles; ligule very short.

Inflorescence a large branching, very pale panicle, with spicate branches bearing heads with many sterile and few fertile spikelets, pale, cylindrical; sterile 7-11 mm. long, the fertile 25-30 mm., often curved. *Glumes* two, ovate, acute. Lowest lemma hermaphrodite or male often gemmiparous, followed by 3-8 hermaphrodite and then 3-5 more or less incomplete florets; rhachilla short, club-shaped, ciliate at the top. *Lemmas* ovate-acute, mucronate, many-nerved, glabrous, pubescent within; palea much shorter, acute, 2-keeled, shortly ciliate on the keels, 3-5 intramarginal nerves. *Lodicules* 3, oblong or narrowly obovate, long-fimbriate. *Ovary* narrowly oblong, attenuate upwards into a thickened hairy style; stigmas three, plumose.

Common in both VALLEYS and ascends in the hills to 4,000 ft.

6. *Bambusa khasiana* Munro, in Trans. Linn. Soc. XXVI (1868) 97.

Culms 10-13 m. tall, growing singly from a creeping rhizome; internodes 12-30 cm. long, covered during youth with glistening golden hairs and variegated with transverse blotches, dark olive-green, 12-36 cm. long; walls thin. *Culm-sheaths* 12-15 cm. long by 10-12 cm. broad, striate, covered with dense, tawny, appressed hairs, straight, truncate at the top; imperfect blade as long as or longer than the sheath, narrow (2.5 cm.) at the base, centre portion thickened, cuspidately acuminate, the sides widened out into large, inflated, membranous wings, broadly rounded on the sheath;

ligule very short. *Leaves* membranous, pale, 10-16 cm. long by 20-25 mm. broad, lanceolate, rounded at the base into a short petiole; leaf-sheaths glabrous, striate, minutely auricled with a few long deciduous hairs; ligule-elongate, truncate.

Inflorescence an ample panicle made up of branches bearing distant sub-verticillate groups of spikelets, of which many are sterile. *Fertile spikelets* 17-22 mm. long, at first cylindrical, afterwards compressed, glabrous, 5-6 flowered, the lower hermaphrodite the upper 1-2 imperfect, sterile, rhachilla striate, smooth, fimbriate at the top. *Glumes* short, ovate, mucronate, brown on the margins, glabrous, median nerve strong. *Lemmas* similar to the glumes; 11-13-nerved, glabrous; palea equalling the lemma or longer, 2-keeled, ciliate on the keels. *Lodicules* ovate-orbicular, many-nerved, shortly fimbriate. *Stamens* with obtuse anthers. *Ovary* linear-oblong; style short; *stigmas* 3, long, plumose.

KHASI HILLS and MANIPUR.

7. *Bambusa nana* Roxb., Hort. Beng. (1814) 25.

A very thick, evergreen, caespitose shrub. *Culms* 2-3 m. tall by 3·0 cm. in diameter, glabrous, smooth, green when young, then yellow, hard, much-branched from the base; branches fasciculate, nodes thickened; internodes 20-40 cm. long. *Culm-sheaths* green at first, then yellow, stiff, glabrous, 10-15 cm. long, 5-7·5 cm. broad, rounded at the top; limb linear, acuminate, decurrent at the base into two indistinct, ciliate auricles, hairy on both surfaces; ligule narrow. *Leaves* mostly small, 2·5-7·5 cm. long, 5-7 mm. broad, rounded at the base into a short petiole, narrowed above into a subulate, twisted point; ligule short.

Inflorescence a rather short, diffuse, leafy panicle, with few spikelets, solitary or clustered. *Spikelets* 1·25-3·75 cm. long, glabrous, straw-coloured, bearing 5 or more florets separated by rhachilla joints 2-5 mm. long, the terminal floret imperfect. *Glumes* absent or rarely only one. *Lemmas* 16-20 mm. long, ovate-acute, many-nerved, glabrous; palea shorter, many-nerved, 2-keeled, minutely ciliate at the top. *Stamens* long-exserted, pendulous; anthers obtuse or shortly

spiculate, yellow. *Ovary* obovate, pubescent at the top; *style* very short; *stigmas* long, plumose. *Caryopsis* elliptic in shape, furrowed, shortly hairy at the top, crowned with the base of the style.

Frequently cultivated as a hedge in tea gardens.

8. Bambusa balcooa Roxb., Hort. Beng. (1814) 25.
Local names :—*Baluka*, Assam; *Sil Barua*, *Teli Barua*, Sylhet.

A tall, stout, densely caespitose bamboo. *Culms* up to 16-24 m., 7·5-15 cm. in diameter, the lower nodes giving off leafless hard branches; internodes 20-45 cm. long; nodes swollen with a whitish ring above, hairy below. *Culm-sheaths* of two kinds; the lower short and broad, densely appressed hairy on the upper surface, ciliate on the edges and the rounded top; imperfect blade short, triangular, decurrent into short, fringed auricles; the upper 25-35 cm. long, 20-25 cm. broad, almost glabrous, truncate; reduced blade 15-20 cm. long, 7·5-10 cm. broad, acuminate, closely hairy below, decurrent at the base on the sheath in a narrow ciliate band. *Leaves* lanceolate, sub-cordate or attenuate at the base, petioled, (petiole hirsute), sometimes long-ciliate at the base, 16-32 cm. long, 12-24 mm. broad, scabrous, shortly hairy below; leaf-sheath striate, appressed white hairy, truncate above with a narrow callus, with a few stiff bristles.

Inflorescence a large, compound panicle, bearing spicate branches with bracteate heads of spikelets; rhachis pubescent. *Spikelets* ovoid-lanceolate, flattened, 9-14 mm. long, 6-8-flowered, the upper and the lower floret sterile, the others hermaphrodite; rhachilla hidden. *Glumes* 0-2, ovate-acute, many-nerved. *Lemma*s membranous, ovate, many-nerved, mucronate, fimbriate on the margins, straw-coloured, at length brown, palea as long as the lemma, ovate-acute, 2-keeled, long ciliate on the keels, with four intracarinal, anastomising nerves. *Lodicules* 3, ovate or obovate, 3-5-nerved, fimbriate. *Stamens* apiculate with a few silky hairs. *Ovary* broadly ovoid, acuminate, hairy; stigmas 3, plumose.

Very common in both VALLEYS of the province where it has a great repute as a durable and strong bamboo.

9. *Bambusa vulgaris Schrader*, in Wendland Collect. Pl. II (1810) 26.

A moderate-sized bamboo with rather distant culms. *Culms* 6-15 m. tall, smooth, 5-10 cm. in diameter, green or striped with yellow lines, polished, shining; nodes hardly swollen, often with a ring of brown hairs; internodes 25-45 cm.; walls thin. *Culm-sheaths* 15-25 cm. long by 17-23 cm. broad, concave at the top, rounded, hairy, often streaked with yellow, ciliate on the margins, glistening smooth within; limb 5-15 cm. long by 10 cm. broad, sub-triangular, acute, hairy on both faces; base decurrent forming two rounded, falciform auricles, which are fringed with wavy stiff bristles. *Leaves* membranous, linear-lanceolate, acuminate or subulate, rounded at the base, shortly petiolate, 15-25 cm. long by 15-40 mm. broad, glabrous or sparsely hairy below, scaberulous on both surfaces; sheaths striate, laxly hairy; auricles round with a few deciduous stiff hairs; ligule short, ciliate.

Inflorescence a large, leafy, compound panicle, bearing spicate branches with heads of spikelets in bracteate clusters of 3-10, the clusters larger at the nodes. *Spikelets* erect, pedicelled, oblong-lanceolate, acute, compressed. *Glumes* 1-2, 6-9 mm. long, ovate-acute; many-nerved, ciliate towards the apex. *Lemmas* 8-15 mm. long, acuminate-cuspidate, attenuate at the base, papyraceous, fimbriate towards the top, 11-19-nerved; paleas 7-14 mm., bluntly acute, 2-keeled, long-ciliate on the keels, faintly 3-nerved. *Lodicules* three, hyaline, unequal in size, two ovate-oblong, the third longer acute, 3-nerved, long-ciliate. *Stamens* exserted, purple; anthers narrow, blunt or apiculate, hairy at the apex. *Ovary* narrowly oblong, hairy; *stigmas* three, short, plumose.

Frequently cultivated and readily recognized by the peculiar yellow stripes on the culms.

10. *Bambusa arundinacea Willd.* Sp. Pl. II (1799) 245. Local names : *Kotoha*, *Kata*, *Koto*, Assam; *Ketua*. *Ketuasi*, Bengali.

A very densely tufted bamboo. *Culms* 16-35 m. tall, bright green, shining, 15-18 cm. in diameter; internodes 45

cm. long, thick, very branched from the base, often flattened on one side or angular; basal branches horizontal, armed at the nodes with 2-3 recurved spines, bearing few leaves; nodes prominent, the lower rooting. *Culm-sheaths* coriaceous, orange-yellow when young, with dense golden hairs, often striped with green or red, rounded at the top; limb triangular up to 10 cm. long, concave, glabrous outside, clothed on the inner surface with a dense mat of dark-coloured felt; margins decurrent on the sheath, wavy, plaited, long and thickly ciliate, auricle very narrow. *Leaves* 7-18 cm. long, 2-10 mm. broad, glabrous above, hairy beneath, linear-lanceolate or linear, attenuate or subcordate at the base, shortly petioled, acuminate, margins smooth or scaberulous; sheaths very hirsute, then glabrescent.

Inflorescence a very large panicle; branches spicate with a few loose clusters of spikelets, each cluster with about 5 spikelets. *Spikelets* lanceolate, acute, 1·75-2·5 cm. long, sessile, 4-6-flowered, rhachis dull, smooth. *Glumes* 2 or absent, ovate-lanceolate, acutely mucronate. *Lemmas* smooth at the base, acuminate or mucronate, sometimes shortly fimbriate at the top, often entirely glabrous; paleas narrower than the lemmas, somewhat longer, 2-keeled, keels ciliate, rhachilla hardly visible. *Lodicules* 3, two sub-obtuse, the third lanceolate. *Stamens* 6, with yellow anthers, sometimes with an apiculate bristle. *Ovary* elliptic-oblong; style short, glabrous; stigmas 2 or 3, long, plumose. *Caryopsis* oblong, 5-8 mm. long, grooved on one side.

SYLHET and the GARO HILLS.

11. *Bambusa mastersii* Munro, in Trans. Linn. Soc. XXVI (1868) 113. Local name:—*Beti bans*, Assam.

A very small reed-like species, climbing. *Leaves* oblong-lanceolate, 25-30 cm. long, 36 mm. broad, glabrous on both surfaces except towards the base of the median nerve, glaucous below, attenuate at the base into a short petiole which is sometimes hairy, terminating in a rostrate-acuminate hairy tip; margins rough; median nerve yellow, shining, secondary nerves 10-12 pairs, intermediate 5, tessellate by reason of a reticulation of oblique lines of pellucid glands; leaf-sheaths

striate, ciliate on the margins, covered on the sides with a coat of stiff appressed hairs, fimbriate at the throat, terminating in a narrow callus and short auricles bearing several, stiff, long, folded bristles; ligule very short.

Inflorescence unknown.

Collected by Masters in Dibrugarh.

9. GIGANTOCHLOA Kurz.

Spikelets ovate and rounded or oblong and compressed, with imperfect florets at the summit and at the base; hermaphrodite florets few; glumes 2 or 3; lemmas as in *Bambusa*; paleas in the hermaphrodite florets 2-keeled, ciliate on the keels; lodicules 3-2, rarely more or one or absent. Stamens 6, monadelphous; anthers mucronate, penicillate at the apex. Ovary often rostrate, more or less hairy above. Caryopsis oblong or linear with a membranous pericarp.

Arborescent or climbing bamboos. Culms usually robust and bare at the base; sheaths auriculate. Inflorescence a compound panicle.

***Gigantochloa macrostachya* Kurz,** Forst. Flor. Burm. II (1877) 557.

A large evergreen bamboo. Culms 10-16 m. tall, 6-10 cm. in diameter, glaucous in youth below the nodes, afterwards dark green in colour; nodes scarcely swollen, hairy; internodes 45-75 cm. long, the lower very short. Culm-sheaths short, 12-20 cm. long, broader than long, contracted at the summit but still broad at the throat, hardly ciliate on the margins; imperfect blade almost as long as the sheath, somewhat acuminate, sub-cordate, furnished on both sides with two large, sinuate auricles, which are densely long-ciliate. Leaves thin, lanceolate, 16-40 cm. long, 12-50 mm. broad, attenuate or rounded at the base into a short petiole, ending above in a scabrid setaceous point, somewhat scabrid on the marginal nerves, otherwise smooth and glabrous, scabrid on the margins, hairy below; sheaths at first hairy, glabrescent; often keeled, terminating at the throat in a rounded callus with two small lateral auricles, which are ciliate; ligule short.

Inflorescence a very large, leafy panicle, composed of heads of spikelets more or less distichously and alternately spaced on the branches; bracts at the base of the branchlets large, sub-foliaceous. *Spikelets* up to 5 cm. long, acuminate, subulate, narrow, covered in part by the long cilia of the glumes and lemmas, hermaphrodite florets 2-3, terminal barren. *Glumes* 2-3, ovate-mucronate, long-ciliate. *Lemma* of the hermaphrodite florets ovate-mucronate, many-nerved; palea very narrow, 2-keeled, ciliate on the keels, bifid at the top, 2-3 nerved between the keels. *Lodicules* absent. *Filaments* exserted, connate at the base into a short tube; *Stamens* purple, connective produced into a hairy acumen. *Ovary* narrowly ellipsoid, surmounted by a long slender style, ending in a single stigma. *Caryopsis* narrow, linear, mucronate.

LOWER ASSAM.

10. OXYTENANTHERA Munro.

Spikelets narrow, elongate, cylindrical or conical, often curved; bearing 1-3 florets, the uppermost usually fertile; rhachilla very short; glumes 1-3; lemmas ovate, elongate, mucronate; palea of the lowest floret 2-keeled, that of the upper floret convolute or scarcely keeled; lodicules absent. *Stamens* 6, monadelphous, exserted, tube at first thick, short, afterwards elongate, membranous; anthers narrow, acute, apiculate; ovary ovoid; style slender; stigmas 3.

Arborescent or climbing bamboos. *Rhizome* thick, creeping or stoloniferous. *Inflorescence* a large panicle with spicate heads of few or many spikelets.

Key to the species of *Oxytenanthera*.

Cilia of glumes black or purple.	..	1. <i>O. nigrociliata</i> .
Cilia of glumes white.	..	2. <i>O. albo-ciliata</i> .

1. *Oxytenanthera nigrociliata* Munro, in Trans. Linn. Soc. XXVI (1868) 128.

An arborescent bamboo, evergreen, living in colonies. *Culms* 10-15 m. tall, caespitose, erect, robust, striate; floriferous branches fascicled at the nodes, up to 1 m. in length; internodes 40-70 cm. long, 5-10 cm. in diameter. *Culm-*

sheaths 15-40 cm. long, rounded-truncate at the top, densely hairy on the back with hairs caducous in the middle line, leaving two hairy regions on either side, margins ciliate; imperfect blade triangular or lanceolate, shorter than the sheath; auricles bright green, rounded, naked, hairy within; ligule narrow, faintly toothed. *Leaves* lanceolate, attenuate at the base into a short petiole, ending in a subulate twisted point, 18-35 cm. long, 3-5.5 cm. broad, somewhat scabrous above, paler below, a little hirsute at first, afterwards glabrous, tessellately nerved; leaf-sheaths stiff, hairy, glabrescent, smooth, ciliate at the edges, terminated by two small thick auricles.

Inflorescence a very large leafy decompound panicle of spicate verticils; verticils about 2-3 cm. apart, consisting of 3-6 spikelets, some fertile, some sterile. *Fertile spikelets* narrow, cylindrical, lanceolate, 1.25-3 cm. long, ciliate with black hairs, 5-7-flowered, the lower 2-3 imperfect, the middle one hermaphrodite, the upper imperfect. *Glumes* 1-3, ovate-acute, mucronate, many-nerved, ciliate on the margins with brown, black or purple hairs; lemmas of the fertile florets lanceolate, acuminate, long-mucronate, ciliate on the margins at the top with brown or violet hairs, many-nerved; paleas as long as or shorter than the lemma, narrow, obtuse, acute or mucronate, 2-keeled, ciliate on the keels, 2-3 intracarinal nerves; lodicules absent. *Stamens* 6, long-exserted, monadelphous; tube finally 1 cm. long or longer, anthers 6-8 mm. narrow, purple, ending in long hirsute points. *Ovary* narrow, ovoid, acuminate, pubescent; style long; stigmas short; plumeose. *Caryopsis* cylindrical, linear-oblong, truncate, furrowed, 14 mm. long, hairy on the top.

GARO HILLS.

2. *Oxytenanthera albo-ciliata* Munro, in Trans. Linn. Soc. XXVI (1868) 129. Local names :—*Kalia* or *Kalisundi*. Sylhet.

An arborescent bamboo, often gregarious, evergreen or deciduous. *Culms* densely tufted, 7-10 m. tall, hispid at the summit; nodes oblique, internodes 15-35 cm. long, by 1.5-2.5 cm. in diameter; walls 6-8 mm. thick. *Culm-sheaths*

thick, hard, 10-20 cm. long by 15 cm. broad, at first covered with tawny appressed hairs, afterwards smooth, folded and coriaceous at the base, somewhat truncate; limb oblong-lanceolate, about as long as the sheath, acuminate, broad and rounded at the base and decurrent; ligule long, truncate. Leaves linear-lanceolate, rounded at the base, shortly petioled, long-setaceous, 15-20 cm. long, 2-2.5 cm. broad, glabrous above, scabrid on one or both margins; leaf sheaths smooth, striate; ligule long, sparsely ciliate.

Inflorescence a spreading, compound panicle. Spikelets in sub-verticillate groups, placed laterally and alternately on the floriferous branches, having yellow, ciliate scales at the base. Spikelets 18-20 mm. long, pale, narrowly cylindrical, often curved, composed of two glumes, one male floret, with a (sometimes) hermaphrodite, no imperfect florets at the top. Glumes ovate-acute, white-ciliate. Lemma elliptic or ovate, acute or feebly emarginate, convolute, many-nerved, white-ciliate; palea shorter, often much shorter, ovate-obtuse, 2-keeled, ciliate on the keels, that of the upper floret not keeled, convolute, ciliate at the top. Stamens long exserted; anthers yellowish-green, long hirsute-apiculate. Ovary narrowly ovoid, long acuminate, pubescent; stigmas two. *Caropsis* elongate, oblong, cylindrical, acuminate, beaked.

SYLHET.

II. ARUNDINARIA Michaux.

Spikelets divaricate-racemose. Glumes indistinctly tessellate, lower subaristate; stamens 3; style 1; stigmas 3, subplumose.

The genus *Arundinaria* has been split up into several genera by Japanese botanists. The true *Arundinaria* grows in North America as pointed out by Nakai in Journ. Arn. Arbor. VI (1925) 189. He considers that, when the flowers of the species below become known, *A. hirsuta* and *A. rolloana* will be found to be species of *Arundinaria*, but that it is impossible to conjecture the correct genus of the remaining two species.

Key to the species of *Arundinaria*.

- Flowers not known.
- Culm-sheaths short, imperfect blade recurved.
- Leaves with conspicuous veinlets.
- | | | | |
|--------------------------------------------------------------|----|----|--------------------------|
| Culms caespitose. | .. | .. | 1. <i>A. hirsuta</i> . |
| Culms distant. | .. | .. | 2. <i>A. rolloana</i> . |
| Leaves without transverse veinlets. | .. | .. | 3. <i>A. suberecta</i> . |
| Culm sheaths very long, imperfect blade
erect, very long. | .. | .. | 4. <i>A. manii</i> . |
- Flowers known.
- Leaves with conspicuous veinlets, tall.
- | | | |
|----|----|-----------------------|
| .. | .. | 5. <i>A. maling</i> . |
|----|----|-----------------------|

1. *Arundinaria hirsuta* Munro, in Trans. Linn. Soc. XXVI (1868) 30.

A small shrubby bamboo with single stems from the rhizome. *Culms* greyish-green, 1·2-2·4 m. tall, 5·7-5 mm. in diameter, nodes glabrous, raised; internodes up to 32·5 cm. long, often strigosely hirsute above, walls rather thin. *Culm-sheaths* papery, about 15 cm. long and 2·5 cm. broad at the base, striate, covered with long, brown hairs, rounded at the top and ending in large, recurved, long-ciliate auricles; imperfect blade subulate, acuminate, recurved; ligule narrow, pubescent. *Leaves* oblong-lanceolate, 7·5-12·5 cm. long, 12·5-17·5 mm. wide, rounded at the base into a short petiole, terminating above in a subulate, twisted, scabrous point, smooth above, pale and strigosely white hairy beneath, edges cartilaginous and scabrous, serrate; leaf-sheaths striate, covered with long, stiff bristles, ending in a hairy callus, and rounded reflexed auricle, bearing long, stiff, almost spinescent, hairy bristles; ligule elongate, often dark-coloured.

Inflorescence unknown.

Forms large stretches beyond Japvo, NAGA HILLS, at 9,700 ft.

2. *Arundinaria rolloana* Gamble, Bamb. Brit. Ind. (1896) 24.

A shrubby bamboo with stoloniferous distant culms, the rhizomes at first covered with shining, acute, glabrous scales, afterwards jointed, the joints about 1·25 cm. long. *Culms* 2·4 m. tall, 2 cm. in diameter, slightly rough, green at first,

afterwards yellow, somewhat flattened on one side; nodes swollen, lower rooting; internodes 20-30 cm. long, walls rather thin. *Culm-sheaths* 10-15 cm. long, 2·5-5 cm. broad, at first covered with scattered appressed bristles, afterwards glabrous, shining, ciliate on the edges, narrowed convexly in the upper third into a rather broad, truncate mouth, which is furnished with long, recurved, rounded, falcate auricles with long bristles; imperfect blade 3·75-5 cm. long, narrow, subulate, recurved; ligule narrow. *Leaves* 15-20 cm. long, by 2·5-3·75 cm. broad, oblong-lanceolate, rounded at the base into a short, very broad petiole, terminating above in a rather short, acute point, smooth above, sparsely hairy beneath; margins cartilaginous, spinulose-scabrous; leaf-sheaths striate, sparsely striate, hairy, ending in a narrow line and a rounded, long-ciliate auricle; ligule long, membranous, deeply cleft.

Inflorescence unknown.

NAGA HILLS, 5-7,000 ft.

3. Arundinaria suberecta Munro, in Trans. Linn. Soc. XXVI (1868) 32.

A graceful, erect, wiry shrub, growing in thick clumps. *Culms* 3-5 m. tall, 7·5 mm. in diameter, olive-green, smooth; nodes slightly swollen; internodes 15-25 cm. long, cavity very small; branches in whorls from the nodes. *Culm-sheaths* 5-15 cm. long, 1·25 cm. broad at the base, thin, papery, striate, glabrous, gradually attenuate upwards to a naked or fimbriate mouth; imperfect blade subulate, leafy, 1·25-3·75 cm. long, recurved; ligule long, fimbriate at the tip. *Leaves* narrow, linear, 5-10 cm. long, 5-7·5 mm. broad, narrowed at the base into an extremely short petiole, setaceous at the tip; margins scabrous, serrate, revolute, smooth above except the scabrous marginal nerves, pale beneath; leaf-sheaths striate, loose, glabrous or slightly hairy when young, ending in a callus and somewhat produced, with a few deciduous bristles; ligule rather long, pubescent.

Inflorescence unknown.

KHASI HILLS, 4-5,000 ft.

4. *Arundinaria manpii Gamble*, Bamb. Brit. Ind. (1896) 26.

A slender, graceful, tufted, climbing, wiry bamboo. *Culms* solid, 1·25 cm. thick 10 m. tall, branched; nodes thickened, bearing many geniculate branches; internodes 1 m. long, smooth. *Culm-sheaths* 30-45 cm. long, convolute, apparently persistent, very thin and slender, 5·7·5 mm. broad at the top, rough with sparse, stiff, brown, appressed bristles; imperfect blade inserted on the sheath, continuous, very long, 22·5-25 cm., linear, ending in a long setaceous point, closely appressed hairy within at the base; ligule narrow, dentate. *Leaves* 15-22·5 cm. long, 17·5-25 mm. broad, thin, papery, lanceolate, rounded or attenuate at the base into a short wrinkled petiole; the tip at first thickened and scabrous hirsute, then surmounted by a long, setaceous apex; surfaces smooth above except the scabrous points on the marginal nerves, somewhat glaucous and sparsely rough hairy beneath, scabrid on one margin; leaf-sheaths glabrous, striate, ending on one side in a round shining callus without an auricle, on the other side in a short pointed auricle with a few long stiff bristles; ligule small, hairy, ciliate.

Inflorescence unknown.

JAINTIA HILLS, 3,000 ft.

5. *Arundinaria maling Gamble*, in Kew Bull. (1912) 139.

An erect shrubby bamboo, 3-9 m. tall, emerging in distant culms from a thick rhizome. *Culms* slender, erect, fistulose; internodes 30-40 cm. long, scabrid above, 2-3 cm. in diameter. *Culm-sheaths* chartaceous-coriaceous, striate, sparsely yellowish-hispid without, margins ciliate, up to 30 cm. long, 10 cm. broad, attenuate at the top, broadly auricled, auricle furnished with long, patent, rigid cilia; imperfect blade subulate, 6-7 cm. long, erect or reflexed, scabrid within; ligule 1 cm. long, fimbriate. *Leaves* chartaceous, linear-lanceolate, attenuate at the base into a short petiole, terminating above in a setaceous-acuminate point, glabrous on both surfaces, margins minutely scabrid, 5-10 cm. long, 8-2 cm.

broad; sheaths striate, glabrous except for a few cilia at the mouth and on the back; ligule pubescent, truncate, short.

Inflorescence a decomound panicle, 10 cm. long, supported at the base by spathaceous bracts; rhachis glabrous, angled; branchlets and pedicels filiform, sinuate, 1-2 cm. long. Spikelets 10-20, 3·5 cm. long, 7-9-flowered, distichous, alternate, uppermost empty; rachilla-joints clavate, curved, flattened on the inner surface, pubescent and ciliate, 5-6 mm. long. Glumes 2, ovate, scabridly setaceous-acuminate; lemma ovate, 7-9-nerved with transverse nerves, 1·1-3 cm. long, scabridly setaceous-acuminate; palea bifid at the apex, 2-keeled, ciliate on the keels, 7-8 mm. long. Anthers 5-6 mm. long, bifid at the apex. Ovary ovoid; style short; stigmas 3, long-plumose. Caryopsis unknown.

Piri, BALIPARA FRONTIER TRACT, 10,000 ft.

12. SEMIARUNDINARIA Makino.

Spikelets racemosely branched or paniculate; glumes coriaceous, inconspicuously tessellate; stamens 3; style 1; stigmas 3, plumose.

Shrubby bamboos; culm-sheaths appendiculate, deciduous or adherent to a dorsal point only; oral setae smooth, rigid.

Semiarundinaria pantlingii Nakai, in Journ. Arn. Arbor. VI (1925) 151, Syn. *Arundinaria pantlingii* Gamble, Bamb. Brit. Ind. (1896) 129.

An erect shrub. Culms tall, smooth, 1·4 cm. in diameter, slightly hairy below the nodes; nodes hairy at the base of the fallen sheath; internodes 17·5-20 cm. long. Culm-sheaths rather thick and tough, 25 cm. long, smooth, striate, long-ciliate on the edges, tapering upwards to a convex top; imperfect blade erect, subulate, 7·5-10 cm. long, glabrous on both surfaces, decurrent on the sheath into rounded, hairy auricles furnished with a few long curved bristles; ligule faintly ciliate, dentate, pubescent on the back. Leaves oblong-lanceolate, long-acuminate, 12·5-17·5 cm. long, 1·5-2 cm. broad, narrowed at the base into a petiole, ending above in a long, scabrous, twisted point, smooth above, rough beneath,

scabrid on one margin; leaf-sheaths striate, glabrous, long-ciliate on the margins, ending in a very hairy ring furnished on either side with a few long twisted bristles; ligule long, pubescent on the back.

Inflorescence of short panicles terminating the culms and the branches, supported by glabrous sheathing bracts like small culm-sheaths, the spikelets hairy on long wavy, capillary glabrous pedicels. Spikelets 5 cm. long or more, curved, very narrow, with 2 empty glumes, 6-10-flowered, the uppermost 2 to 4 lemmas usually barren. Glumes 2, lower 5 mm., the upper 10 mm. long, 3-5-nerved, ovate-acuminate, mucronate, slightly ciliate; lemmas rather longer than the upper glume, long-mucronate, 7-nerved, scabrous on the midrib; palea as long or longer than the lemma, 2-keeled, ciliate on the keels, bifid at the apex. *Lodicules* 3, obovate or ovate-acute, faintly nerved and ciliate. *Stamens* 3, filaments short; anthers linear, acute. *Ovary* glabrous; style short; stigmas 3, long-plumose. *Caryopsis* oblong, dark-brown, grooved, surmounted by the persistent base of the style.

Piri, BALIPARA FRONTIER TRACT, 10,000 ft.

13. CHIMONOBAMBUSA Makino.

Spikelets racemose; glumes not tessellate but longitudinally nerved; nerves raised; stamens 3; styles 2; stigmas plumose.

Shrubby bamboos. Culm-sheaths almost inappendiculate; oral setae smooth.

Key to the species of *Chimonobambusa*.

- Inflorescence on leafy branches.
- Culm-nodes without spines. 1. *C. polystachya*.
- Culm-nodes with spines.
 - Inflorescence terminal; glumes mucronate. 2. *C. griffithiana*.
 - Inflorescence axillary, glumes obtuse. 3. *C. callosa*.
- Inflorescence on separate leafless culms.
 - Leaves without transverse veinlets. 4. *C. khasiana*.
 - Leaves with transverse veinlets.
 - Leaf-sheaths ciliate, florets 3-5 fertile. 5. *C. intermedia*.
 - Leaf-sheaths not ciliate, floret 1, usually fertile. 6. *C. hookeriana*.

1. Chimonobambusa polystachya Nakai, in Journ. Arn. Arbor. VI. (1925) 151. Syn. *Arundinaria polystachya* Kurz ex Gamble, Bamb. Brit. Ind. (1896) 7.

A small shrubby bamboo with rather soft culms. *Culm-sheaths* not known. *Leaves* soft, green, 15-20 cm. long, 15-25 mm. broad, long-acuminate, rounded or attenuate at the base into a short petiole, rough above, sparsely hairy below or smooth below, scabrid on one margin; leaf-sheaths greenish yellow, striate, glabrous, ending in a broad bifid callus, produced upwards to meet the ligule; ligule long, striate, blunt, fimbriate.

Inflorescence a terminal or axillary, racemose, leafy panicle, bearing narrow, papery bracts 2.5 cm. long; rachis channelled on one side. *Spikelets* pedicellate, 1.25-1.8 cm. long, 4-6-flowered, with the uppermost flower imperfect; rachilla claviform, visible, covered with white hairs. *Glumes* 2, ovate-acuminate, 5-7.5 mm. long, 5-7-nerved, keeled and ciliate towards the tip; lemmas ovate, long-acuminate, 10-12.5 mm. long, 7-9-nerved, ciliate on the edges; paleas longer than the lemma, 2-keeled, ciliate on the keels, mucronate, bifid at the apex, 1 nerve intercarinal and 1 nerve extracarinal. *Lodicules* 3, usually 2 ovate, obtuse, fimbriate, with 3 conspicuous areolate veins, the other veins smaller; the third ovate, acute, 3-nerved. *Stamens* exserted often flexuous; anthers long, apiculate. *Ovary* ovoid, glabrous; style short, with two long plumose stigmas.

Common in the KHASI HILLS.

2. Chimonobambusa griffithiana Nakai, in Journ. Arn. Arbor. VI. (1925) 151. Syn. *Arundinaria griffithiana* Munro, in Trans. Linn. Soc. XXVI (1868) 30.

An erect bamboo covering large areas. *Culms* erect single, 3-10 m. tall, 2.5-3.75 cm. in diameter, olive-green; nodes prominent, armed with a circle of short spines; internodes 17.5-22.5 cm. long, striate, furrowed, furnished with a ring of tawny hairs at the base of the node. *Culm-sheaths* striate, longer than the internodes, 15-22.5 cm. long, 10-12.5 cm. broad at the base, where they bear a belt of thick, tawny, soft hairs, gradually and somewhat convexly attenuate upward to

a truncate top 7 mm. broad; the apex furnished with rounded auricles, back covered thinly with scattered, stiff hairs from bulbous bases, edges ciliate; imperfect blade 5-25 mm. long, triangular, acute, hairy; ligule short, hairy, ciliate; leaves linear-lanceolate, acuminate, thin 10-12·5 cm. long, 10-12·5 mm. wide, narrowed at the base into a short petiole, terminating above in a long, setaceous, somewhat scabrous point, smooth above, pale below, margins smooth; leaf sheaths striate, glabrous, ciliate on the edges, ending in a narrow ring with a few curved bristles; ligule hairy without.

Inflorescence a terminal panicle, surrounded with sheathing bracts, hairy at the base and ciliate on the edges. *Spikelets* 2·5-3·75 cm. long, narrow with 2 empty glumes, 4-6-flowered in verticillate clusters on thin wavy scabrid hairy pedicels; rhachis hairy, flattened on one side; rhachilla long, 5-7·5 mm., flattened, hairy, ciliate at the clavate top. *Glumes* 2, ovate-lanceolate, mucronate, 5-7-nerved, scabrous hairy on the back; lemmas 12·5 mm. long, lanceolate, long mucronate, scabrous, hairy above, 7-nerved; paleas nearly as long, bimucronate, 2-keeled, ciliate on the keels. *Lodicules* 3, obovate, faintly nerved, long ciliate, one shorter and narrower. *Stamens* apparently not exserted; anthers emarginate, crowned with a few fine long hairs. *Ovary* linear-oblong; glabrous, style short; stigmas 2, long, plumose.

A very common bamboo in the NAGA, KHASI and AKA HILLS. It often forms the only underwood in evergreen hill forest.

3. *Chimonobambusa callosa* Nakai, in Journ. Arn. Arbor. VI. (1925) 151. Syn. *Arundinaria callosa* Munro, in Trans. Linn. Soc. XXV (1868) 30.

A shrubby thorny bamboo. *Culms* 4-7 m. tall, 1·25-2·5 cm. in diameter, greyish-green, smooth, striate when young; nodes raised in a ring which is subtended by the base of the fallen sheath fringed with soft brown hairs, and which is studded with thick, short, conical spines, the said spines breaking through the sheath when the latter is detached; internode 15-25 cm. long, nearly solid at the base, the wall higher up being rather thin. *Culm-sheaths* as long as or longer than the internodes, loose, thin, striate, smooth, transversely veined,

ciliate on the edges, gradually attenuate upwards from a hairy base to a 5 mm. truncate apex; imperfect blade 12·5-25 mm. long, subulate, hairy without and within, decurrent on the sheath in long-fringed, short auricles; ligule 2·5 mm. long, fimbriate. Leaves 20-22·5 cm. long, 17·5-32·5 mm. wide, oblong-lanceolate, thin; unequally attenuate at the base, shortly petioled, terminating in a scabrous acuminate point, finely glandular-scabrous above, especially on the marginal veins, pale and pubescent beneath, scabrid-serrate on the margins; leaf-sheath densely tawny pubescent, glabrescent, ending in a short ciliate callus, with a few, stiff, curved bristles.

Inflorescence a branched panicle ending in a leafy branchlet; the nodes of the panicle subtended by sheathing papery bracts. Spikelets 5-7·5 cm. long, subtended by glabrous, narrow, straw-coloured bracts 6-12-flowered; rhachillæ very prominent, 5 mm. long, curved, flattened, glabrous. Glumes 2, short, glabrous, ovate-acute, 1-3-nerved; lemmas ovate, acute, mucronate, ciliate at the apex, 3-7-nerved; paleas acute, 2-keeled, thickly pubescent, keels ciliate. Lodicules 3, ovate, faintly nerved, fimbriate, one smaller. Anthers short blunt. Ovary ovate, glabrous; style short; stigmas 2, shortly plumose.

AKA and KHASI HILLS, 5-6,000 ft. Also found on the Saramethi ridge at 7,000 ft.

4. *Chimonobambusa khasiana* Nakai, in Journ. Arn. Arbor. VI. (1925) 151. Syn. *Arundinaria khasiana* Munro, in Trans. Linn. Soc. XXVI (1868) 30.

A thick bushy shrub. Culm 2·5-4 m. tall, 1·25 cm. in diameter, smooth, dark green, almost black; nodes prominent; internodes 15-20 cm. long; branchlets very many from the nodes, geniculate, dark-coloured. Culm-sheaths papery, straw-coloured, 15-22·5 cm. long by 3·75-5 cm. broad at the base, striate, smooth, upper part with transverse veinlets, tapering from the middle to a narrow tip; imperfect blade narrower than the apex of the sheath, subulate, recurved, 2·5 cm. long; ligule 5-7·5 mm. long, subulate, dentate or lacerate. Leaves linear-lanceolate, 7·5-10 cm. long by 7·5 mm. broad, attenuate at the base into a short petiole, terminating above in a twisted setaceous point, smooth on both sides or sometimes slightly

pubescent beneath, scabrid on both margins; leaf-sheaths thin, striate; ligule rather long.

Inflorescence on separate leafless culms, consisting of falcate, branching, geniculate panicles, fascicled at the nodes, and subtended by membranous, short ovate bracts. Spikelets 1·1-2·5 cm. long, 2-3-flowered; rhachilla produced. Glumes 2, short, the lower 3-, the upper 5-7-nerved, shortly mucronate, ciliate at the tip and on the margins; lemmas similar, longer and stiffer, sometimes minutely scabrous-pubescent; paleas longer than the lemmas, 2-keeled, glabrous except the ciliate tip, acute or bifid, 1-nerved on either side of the keels. Lodicules 3, ovate-obtuse, or one acute, fimbriate, 3-7-nerved, nerves brown. Anthers blunt at the apex. Ovary glabrous, elliptic; style short; stigmas plumose.

Quite common in the KHASI HILLS, 5-6,000 ft.

5. *Chimonobambusa intermedia* Nakai, in Journ. Arn. Abor. VI. (1925) 151. Syn. *Arundinaria intermedia* Munro, in Trans. Linn. Soc. XXVI (1868) 28.

A slender caespitose bamboo. Culms smooth, greyish-green, 3-4 m. tall; nodes swollen with a prominent ring and a whitish line below them; internodes 12·5-25 cm. long; branches many from the nodes. Culm-sheaths glabrous, papery, strongly striate, 20-25 cm. long, by 2·5-5 cm. broad, ciliate below the blade; imperfect blade narrow, subulate, up to 5 cm. long, recurved; ligule up to 5 mm. long, blunt. Leaves bright green, very variable, 7·5-20 cm. long, attenuate at the base into a short swollen petiole, terminating in a setaceous point, scabrous above and on both margins, pale and smooth or hairy near the mid-rib beneath; leaf-sheaths striate, glabrous or with scattered, long, stiff hairs above; callus minute; auricle falcate with curving, deciduous bristles; ligule elongate, obtuse or triangular.

Inflorescence on leafless stems consisting of racemose panicles verticillate from the nodes, subtended by membranous bracts; rhachis smooth, dark, with small triangular bracts below and sometimes a tuft of hair above at the axils. Spikelets 1·25-2·5 cm. long, yellow or purplish, 3-5-flowered, rhachilla produced and crowned by an imperfect floret or

naked; rhachilla clavate, compressed, long ciliate above. *Glumes* 2, pale, ovate, membranous, the lower 3-5-, the upper 7-9-nerved, blunt or acute, ciliate at the tip; lemma similar but shortly mucronate, 7-9-nerved, often minutely scabrous on the dorsal surface; palea longer than the lemma, bi-mucronate, 2-keeled, ciliate on the keels. *Lodicules* 3, ovate, fimbriate. *Stamens* slightly exserted; anthers blunt or slightly apiculate. *Ovary* linear-oblong, glabrous; style short; stigmas 2, plumose; caryopsis short, oblong, swollen in the middle, tipped with the persistent base of the style.

Piri, BALIPARA FRONTIER TRACT, 10,000 ft.

6. Chimonobambusa hookeriana Nakai, in Journ. Arn. Abor. VI. (1925) 151. Syn. *Arundinaria hookeriana* Munro, in Trans Linn. Soc. XXVI (1868) 29.

A caespitose bamboo. *Culms* 5-6 m. tall, glaucous-green in colour, covered with a white scurf when young, often striated green and yellow: nodes with dark bluish rings below, prominently ringed with the persistent base of the sheath; internodes 20 cm. long, fistular; walls thin. *Culm-sheaths* papery striate, 30-60 cm. long, 7.5-15 cm. broad at the base, attenuate to a truncate summit; imperfect blade linear, 7.5-15 cm. long, 2.5-3.5 mm. broad; ligule short. *Leaves* linear-to-oblong-lanceolate, glaucous-green when young, 15-30 cm. long, attenuate at the base into a short petiole, ending above in a scabrous setaceous point, somewhat rough above, pale and glabrous beneath, margins scabrous; leaf-sheaths striate, glabrous but minutely ciliate at the margins, ending in a broad callus and thin membrane without bristles; ligule long, conspicuous.

Inflorescence of loose, falcate, racemose panicles fascicled at the nodes of a leafless culm. *Spikelets* about 8 mm. long, pedicellate, 1-flowered with a terminal imperfect floret. *Glumes* 2, oblong, thin, membranous, the lower 2.5, the upper 5 mm. long; the lower 3-nerved hairy at the tip, the upper 5-nerved, mucronate; lemma large, hard, broadly ovate, involute, angled, prominently 3-nerved; palea thick, 2-keeled, glabrous, hirsute on the prolonged tip. *Lodicules* 3, thickened at the base and coloured, obovate, acute or rounded, fimbriate, 3.5-

nerved. *Stamens* exserted, anthers subacute. *Ovary* ellipsoid, glabrous; style short; stigmas 2, short, plumose. *Grain* ellipsoid, dark, smooth, tipped with the pointed base of the style.

Piri, BALIPARA FRONTIER TRACT, 6-8,000 ft.

14. SINOBAMBUSA Makino.

Spikelets racemose, sub-phyllopodous; glumes tessellate, acute; stamens 3; styles 2; stigmas plumose.

Shrubby bamboos. *Culm-sheaths* deciduous, appendiculate; internodes extremely long; oral setae smooth, rigid.

Sinobambusa elegans Nakai, in Journ. Arn. Arbor. VI (1925) 152. *Syn. Arundinaria elegans* Kurz, in Jour. As. Soc. Beng. XLII (1873) 248.

An evergreen, slender, tufted, shrubby bamboo. *Culms* green or blackish, 4-7 m. tall, flattened on one side in alternate internodes; nodes somewhat raised; internodes 17-23 cm. long. *Culm-sheaths* one-third the length of the internodes, papery, striate, minutely hispid above, narrowed in the upper third to a truncate mouth bearing minute auricles; imperfect blade narrow, subulate, recurved; ligule rather broad, finely ciliate. *Leaves* linear-lanceolate, long-acuminate, 10-12.5 cm. long, 7.5-12.5 mm. wide, shortly petioled, smooth above, glaucous beneath, cartilaginous and scabrid on the margins, tessellately nerved; sheaths striate, smooth, ending in a minutely ciliate callus; ligule very short.

Inflorescence a terminal interrupted leafy panicle or raceme, bearing pedicellate spikelets; rhachis thin, wiry, curving, pubescent. *Spikelets* 2.5 cm. or more long, flattened, 7-8-flowered; rhachilla visible, wiry, clavate. *Glumes* 2, 5 mm. long, 3-5-nerved, ovate-acuminate, keeled, ciliate on the keel; lemmas similar, 7-nerved, with transverse veins; palea shorter, 2-keeled, white-ciliate on the keels, obovate, bifid at the apex, 2-nerved between the keels, 1-nerved on either side. *Lodicules* 3, 3-5-nerved, ovate, acute, long-ciliate. *Stamens* hardly exserted; anthers purple, rounded or mucronate at the tip. *Ovary* smooth, oblong, surmounted by the short style; stigmas 2, white plumose.

A common bamboo on the slopes of Pulebadze, Kohima, NAGA HILLS, where it is much sought after as the shoots are made into a pickle.

15. THAMNOCLAMUS Falconer.

Spikelets 1-8-flowered, with upper florets more or less incomplete, arranged in simple leafy racemes, the leaves forming sheaths or bracts. *Glumes* indistinctly nerved, about a third shorter than the spikelets; lemma acute or long-acuminate, equalling or exceeding the palea in length; lodicules 3, rarely 6. *Style* short; stigmas 3.

Caespitose bamboos. *Culms* fistular, cylindrical, arching; culm-sheaths rapidly caducous. *Inflorescence* with sheathing bracts at the base.

Key to the species of *Thamnocalamus*.

Erect shrubs.

Transverse veinlets conspicuous; bracts large.				
Bracts narrow, enclosing 2-3 spikelets. . . .	1.	<i>T. spathiflorus</i> .		
Bracts broad, enclosing 3-5 spikelets. . . .	2.	<i>T. aristatus</i> .		
Transverse veinlets inconspicuous; bracts short. . . .	3.	<i>T. falconeri</i> .		
Scandent shrub. . . .	4.	<i>T. prainii</i> .		

1. **Thamnocalamus spathiflorus** Munro, in Trans. Linn. Soc. XXVI (1868) 34. Syn. *Arundinaria spathiflora* Trin. in Mem. Acad. Petersb. Ser. 6. III (1835) 617.

A gregarious, caespitose, shrubby bamboo. *Culms* up to 6 m. tall, smooth, fistular; internodes 15-36 cm. long; branches 30-45 cm. long, woody, glabrous; branchlets semi-virgillate, fasciculate, shining; nodes hardly prominent, marked by a white ring. *Culm-sheaths* straw-coloured, coriaceous, thin, loose, smooth inside, striate without, with ciliate margins; margins parallel to near the top where they are slightly narrowed convexly into a truncate, rounded mouth; imperfect blade 5-10 cm. long, erect, subulate, decurrent on the sheath, caducous; ligule short, fimbriate. *Leaves* clustered in groups of 2-4 at the ends of short, jointed branches which bear loose, narrow, yellow sheaths, 7-5-12.5 cm. long, linear-lanceolate, attenuate at the base into a short petiole, terminating above in an acute hairy point, smooth on

both surfaces, scabrous on the margins; leaf-sheaths loose, 5·7-5 cm. long, straw-coloured, striate, ciliate on one margin, truncate at the top into a narrow, ciliate callus and bearing short auricles with a few long purple bristles; ligule long ciliate.

Inflorescence usually on separate leafless culms, sometimes leafy; rhachis very slender, much jointed, bearing at the joints papery straw-coloured, narrow sheaths 3·75-7·5 cm. long, truncate or with an imperfect blade, which enclose 2-3 pedicellate (or one sessile) spikelets. *Spikelets* loose, compressed, 2·5-6·25 cm. long, with 2 glumes and 4-8 hermaphrodite florets; rhachilla long-clavate, white-hairy at the tip. Glumes 2, linear-lancolate; one obtuse, short, the other long, mucronate, striate, glabrous; lemmas ovate, long-acuminate, mucronate, 1·5-2·5 cm. long, scabrous, striate; palea much shorter, 2-keeled, ciliate on the keels, sometimes bifid, 1-2-nerved. *Lodicules* 3, ovate-falcate or ovate-acute, 3-5-nerved, fimbriate. *Stamens* long-exserted; anthers blunt. *Ovary* glabrous, ovoid, elongate; style short; stigmas 3, long plumose. *Caryopsis* linear-oblong, glabrous, furrowed.

Probably occurs on Piri, BALIPARA FRONTIER TRACT, 10,000 ft., as it is common in BHUTAN.

2. *Thamnocalamus aristatus* E. G. Camus, Bamboosées (1913) 54. Syn. *Arundinaria aristata* Gamble, Bamb. Brit. Ind. (1896) 18, t. 17.

A tufted bamboo with robust culms. *Culms* at first mealy white, then glaucous green, afterwards a brilliant yellow. 2·5-4 m. high, 12-15 mm. in diameter; nodes hardly inflated; internodes 20-30 cm. long. *Culm-sheaths* 15-20 cm. long, 7-7·5 cm. broad at the base, gradually attenuate towards the truncate summit; ligule short, pubescent; imperfect blade linear, scarcely subulate, decurrent, 24-48 mm. long. *Leaves* grouped in twos and threes at the top of the branchlets, oblong-lanceolate, attenuate at the base into a long, glandular, 4·5 mm. long petiole, terminating above in a setaceous point, glabrous or sparsely hairy below, scabrid on one margin; median nerve narrow shining; lateral nerves 3-5 pairs, tessellate; leaf-sheaths lax-striate, 5-7·5 cm.

long, terminating in a callus clothed with long hairs; ligule long, acute or truncate.

Inflorescence composed of long racemes grouped in panicles at the top of the culms, the articulations of the branchlets with large spathe-like bracts, which enclose 3-5 shortly pedicelled spikelets. *Bracts* 36-50 mm. long, 12-15 mm. broad, carrying a foliaceous, more or less developed, limb. *Spikelets* 25-50 mm. long, 4-8-flowered, terminal floret barren; rhachilla visible, articulate, whitish, hairy below the nodes. *Glumes* similar, membranous, oblong-lanceolate, scaberulous at the top, keeled, mucronate, 3-5-7-nerved. *Lemma* ovate, long acuminate, dark coloured, scabrous-hirsute, with 9 prominent nerves; palea somewhat shorter, 2-keeled, 2-cuspidate at the top, with ciliate keels, scabrous, nerved within and without the keels. *Lodicules* lanceolate-acute, ciliate, 3-nerved. *Stamens* purple, obtuse at the apex. *Ovary* ovate, short-styled with 3 hairy stigmas. *Grain* linear-oblong, dark brown in colour, furrowed on one side.

On Piri, BALIPARA FRONTIER TRACT. 10,000 ft.

3. Thamnocalamus falconeri Hook, f. apud Munro,
in Trans. Linn. Soc. XXVI (1868) 34. Syn. *Arundinaria falconeri* Benth. et Hook. f., Gen. Pl. III, 1208.

A laxly caespitose bamboo. *Culms* fistular, smooth when young, covered with a white scurf when old, frequently striped yellow and green; nodes raised; internodes 10-15 cm. long; branchlets almost filiform, rigid, fascicled at the nodes. Culm-sheaths striate, hairy when young, straw-coloured, papyraceous, 20-30 cm. long, 50-75 mm. broad, ciliate on the margins, attenuate and truncale at the top; imperfect blade subulate, recurved, 7.5-12 cm. long, 5-7 mm. broad; ligule narrow, hairy. *Leaves* 7.5-10 cm. long, 7-14 mm. broad, narrow, thin, pale, attenuate at the base into a somewhat long petiole furrowed above, ending above in an acuminate or subsetaceous point, scabrid on the margins; sheaths glabrous, truncata above, not fimbriate; ligule elongate, hairy.

Inflorescence a panicle with racemously arranged branchlets, with one or more racemes of spikelets 2.5 cm. long;

supported at the base by spathiform and chaffy bracts. *Spikelets* 5-7 in each raceme, glabrous, 7-9 mm. long, shortly pedicelled, 1-flowered or rarely 2-flowered; rhachilla produced and carries a sterile floret. *Glumes* 2, membranous, oblong, acute or mucronate, 3-5-nerved; lemma ovate-lanceolate, 5-7-nerved, shortly mucronate, ciliate at the tip; palea as long or longer, 2-keeled, furrowed on the back, bifid at the top. *Lodicules* almost equal, fimbriate. *Stamens* exserted, obtuse or shortly apiculate, purple. *Ovary* ovate, glabrous; style short; stigmas 3. *Grain* linear, oblong, furrowed.

Piri, BALIPARA FRONTIER TRACT. 10,000 ft.

4. *Thamnochalamus prainii* E. G. Gamus, Bambusées (1913) 54, Syn. *Arundinaria prainii* Gamble, Bamb. Brit. Ind. (1896) 21.

A small, wiry, climbing shrub. *Culms* thin, slender, smooth, yellowish, curving, up to 10 m. long, 5-7.5 mm. in diameter; nodes swollen in a well-marked ring; internodes short, usually 20-22.5 cm. long, wall thick, often quite solid; branches fasciculate at the nodes. *Culm-sheaths* thin, somewhat scabrous above, 2-15 cm. long; 10-20 mm. broad, attenuate convexly in the upper half to a narrow edge; imperfect blade short, 2.5-5 mm. long, subulate; ligule short, rounded. *Leaves* thin, oblong-lanceolate, 5-10 cm. long, 7.5-17.5 mm. wide, round at the base into a short petiole, terminating above in a long, curved, setaceous point, scabrid on one margin; leaf-sheath striate, smooth; ligule long, rounded, blunt.

Inflorescence in terminal or axillary panicles, bearing distant spikelets in the axils of sheath-like straw-coloured bracts; rhachis very slender, wiry, smooth, geniculate. *Spikelets* 2.5-3.5 cm. long, on slender pedicels, 3-6-flowered, uppermost flower imperfect, distichously arranged on the alternate sides of a wiry flexuous rhachis. *Glumes* usually 2 (or 3), the lower keeled, ciliate on the margins, lanceolate, the upper ovate-acute, 3-5-nerved, ciliate at the tip; lemmas triangular, falcate, acute, glabrous, 9-11-nerved; paleas falcate, as long as the lemmas, 2-keeled, minutely ciliate on the keels, acute or bifid at the apex. *Lodicules* 3, two broadly

ovate, 3-nerved, ciliate, the third lanceolate-acute, 1-3-nerved. *Stamens* 6; anthers purple, bluntly apiculate. *Ovary* oblong, hairy above; style thick, bulbous at the base; stigmas 3, plumose.

On Pulebadze, Kohima, NAGA HILLS. 6,000 ft.; also in the JAITIA HILLS about 3,500 ft.

16. PHYLLOSTACHYS Sieb. et Zucc.

Spikelets sessile, 1-4-flowered; rhachilla articulate between the florets; glumes 1-2, many-nerved, often unequal, glabrous, often ending in an imperfect limb; lemmas ovate-lanceolate, acuminate, many-nerved; paleas 2-keeled, often bi-mucronate, many-nerved; lodicules often 3, unequal, lanceolate-acute, nerved. *Stamens* 3, long exserted; anthers linear. *Ovary* stipitate, ovoid or globose, glabrous; style long; stigmas 3, long, plumose.

Shrubby or arborescent bamboos, caespitose. *Culms* smooth, rough or pubescent, flattened on one side in alternate nodes; nodes prominent; internodes rather short; branches 2-3-nate at the nodes; culm-sheaths papyraceous, striate, tessellate, rounded, ending in a subulate imperfect limb. *Leaves* small or medium-sized, petioled, articulate on the sheath; sheaths loose, smooth.

Inflorescence a terminal panicle, rather lax, covered with spathiform, imbricate bracts, which often end in an imperfect limb.

Key to the species of *Phyllostachys*.

- | | |
|-------------------------------------------------------------------|-------------------------|
| Leaves thin, leaf-sheaths long, bristly at the mouth. | 1. <i>P. assamica</i> . |
| Leaves thick, leaf-sheaths with hardly any bristles at the mouth. | 2. <i>P. manni</i> . |

1. *Phyllostachys assamica* Gamble ex Brandis, Ind. Trees (1906) 667.

A caespitose bamboo. *Culms* 10-12 m. tall, brilliant green in colour, up to 20 cm. in diameter, sometimes more, with a waxy ring below the nodes which disappears with age; nodes glabrous and internodes short. *Culm-sheaths* 15-25 cm. long, thin, contracted at the summit into a short, truncate

or rounded collar, covered with black hairs, which are at first appressed, afterwards erect and caducous; imperfect limb-subulate, papyraceous, at first erect then turned backwards and downwards; striations dark green in the centre, pink on the margins; auricles small if present, often absent. *Leaves* broadly linear, glaucous, shortly petioled, somewhat long acuminate-setaceous at the tip, 8-12 cm. long, 12-16 mm. broad, toothed on the margins, covered on the lower surface with stiff white hairs; sheaths keeled, ciliate on the margins, shortly auricled, throat with a few hairs.

Inflorescence a panicle made up of spikes of lanceolate spikelets; bracts ciliate at the throat, with a foliaceous limb, large, ovate-lanceolate, 35 mm. long, by 20 mm. broad. *Spikelets* brownish or greenish, 20-25 mm. long, with 3-5 perfect florets, the upper floret imperfect. *Lower glume* very large, rather like a sheath, often terminated by a very small limb; upper glume short, oblique, obliquely acute, few-nerved, 2-keeled, those of the upper spikelets longer and with more unequal sides, often absent in the uppermost spikelet; lemmas ovate-acute, many-nerved; nerves strong; paleas as long as the lemmas, narrow, bi-mucronate at the top, 2-keeled, ciliate on the keels. *Lodicules* ovate-lanceolate or oblanceolate, sometimes emarginate or bifid, fimbriate, 3-7-nerved unequal. *Stamens* exserted, pendulous; connective apiculate. *Ovary* ovoid, furrowed at the base.

MISHMI HILLS, collected by Griffith near Premsong's village.

2. *Phyllostachys mannii* Gamble, Bamb. Brit. Ind. (1896) 28.

A caespitose shrub. *Culms* 5-6 m. tall, 2·5-3 cm. in diameter; internodes 20 cm. long, yellow, flattened on one side. *Culm-sheaths* papery, straw-coloured, 20-22·5 cm. long, 2·5-5 cm. broad, rounded at the top and truncate, extended at the base of the blade into two short, fimbriate, caducous, curved auricles; imperfect blade 5-7·5 cm. long, recurved, narrow, subulate, decurrent on the sheath; ligule broad, long-pectinate. *Leaves* thick, 10-12·5 cm. long, 1·25-2 cm. wide, rounded at the base into a petiole 7·5 mm. long, shortly acuminate at the tip, smooth and glabrous on both surfaces

except for a few white hairs near the midrib below, spinulose-serrate on one edge; transverse nerves extremely numerous; leaf sheaths loose, glabrous, smooth, straw coloured, ending in a narrow ciliate callus with a few deciduous bristles.

Inflorescence unknown.

This bamboo is commonly cultivated in Shillong, KHASI HILLS, 5,000 ft.

2. CENTOTHECEÆ.

Perennial grasses with broadly lanceolate leaf blades, tessellately nerved.

Inflorescence a dense, loose or simple panicle; spikelets laterally compressed or almost terete, either pedicelled or subsessile. *Spikelets* 1- to several-flowered, in the case of the former the fertile floret being succeeded by several empty lemmas; in the latter, the florets being all hermaphrodite or the uppermost reduced; rhachilla disarticulating either above or below the glumes. *Lower glume* smaller than the upper, membranous; lemmas similar in texture, mucronate, glabrous or bearing tubercle-based reflexed bristles, shortly awned or mucronate. *Lodicules* 2. *Stamens* 2-3.

Key to the genera of *Centothecæ*.

- | | |
|-------------------------------------------|-------------------------|
| Spikelets 2- to several-flowered. | 1. <i>Centotheca</i> . |
| Spikelets with 1 fertile floret. | 2. <i>Lophatherum</i> . |

1. CENTOTHECA Desv.

Spikelets laterally compressed, linear, oblong or obovate-oblong, awnless, pedicelled on the slender branches of loose or contracted panicles; rhachilla very slowly disarticulating above the glumes and between the florets. Florets two to many, (hermaphrodite or the uppermost reduced, very rarely the lowest reduced to its lemma), exserted from the glumes. *Glumes* persistent, slightly unequal, acute or obtuse, keeled, membranous, 3-5-nerved. *Lemmas* lanceolate to ovate or oblong in profile, acute or obtuse, usually mucronulate, keeled, herbaceous, firmly membranous or chartaceous, 7-9-nerved, all smooth, or the lower one or two smooth and the upper bearing short, rigid, spiny, tubercle-based bristles near the margins. *Palea* as long as or slightly shorter than the lemmas, 2-keeled. *Lodicules* 2. *Stamens* 2-3. *Ovary* glabrous. *Caryopsis* ovoid-oblong, free

between lemma and palea; scutellum small; hilum sub-basal.

Perennial grasses with broad, flat leaf-blades and terminal panicles.

A genus of three species in tropical Africa, Madagascar, Asia, Polynesia and N.E. Australia.

Centotheca lappacea Desv. in Nouv. Bull. Soc. Phil. II (1810), 189.

A loosely tufted perennial. Culms mostly geniculately ascending, rarely erect, 15—120 cm. high, slender to stout, simple or branched, 5- to many-noded, glabrous and smooth. Leaves glabrous, rarely hairy; sheaths prominently striate; ligules truncate, up to 2 mm. long, lacerate; blade lanceolate, ovate-lanceolate or narrowly elliptic, contracted or tapering at the base, acute or acuminate, 6-25 cm. long, 8-32 mm. wide, flat, rough on the margins, finely nerved with prominent transverse veinlets.

Panicle loose, 7.5-25 cm. long and up to 20 cm. wide, green; rhachis glabrous or hairy at the nodes, minutely scaberulous upwards; branches numerous, very slender, spreading, at length becoming deflexed and disarticulating from the rhachis, loosely divided below and simple upwards, up to 15 cm. long; pedicels capillary, very unequal, scaberulous or minutely pubescent. Spikelets oblong or ovate-oblong, 4-7 mm. long, loosely 2-4-flowered; rhachilla produced and bearing a rudimentary floret. Glumes narrowly-lanceolate to lanceolate-oblong in profile, acute, sometimes mucronate, 3-4 mm. long, keeled, 3-5-nerved, persistent. Lemmas oblong-acute or ovate-obtuse, apiculate, rounded dorsally, 5-7-nerved, those of the upper florets furnished with reflexed, rigid, short, tubercle-based bristles near the margins; paleas shorter, narrow, often decurrent on the rhachilla; lodicules absent. Stamens 2-3; anthers short, linear. Ovary surmounted by two short styles; stigmas short, hairy. Caryopsis ovoid-acute, rounded, free but enclosed between lemma and palea.

A common forest grass in plains and hills up to 4,000 ft.

2. **LOPHATHERUM** Brongn.

Spikelets laterally compressed or almost terete, lanceolate, solitary, subsessile, falling entire at maturity, secund on the slender, simple branches of a lax panicle; rhachilla continuous. *Fertile floret* with several sterile (up to 9) florets above it on a long rhachilla joint, the sterile florets being closely imbricate and reduced to their lemmas. *Glumes* slightly unequal, elliptic-oblong, obtuse, herbaceous, 5-7-nerved, the lower smaller. *Fertile lemmas* longer than the glumes, ovate-oblong, mucronate or shortly awned from the tip, with the awn retroseely scabrid, herbaceous; palea linear, as long as the lemma, thinly membranous, 2-keeled, with the keels very narrowly winged. *Lodicules* 2. *Stamens* 2-3. *Caryopsis* narrowly oblong, free between the lemma and palea; scutellum small; hilum elongated. *Sterile lemmas* much smaller and narrower than the fertile but similar in texture.

Perennial grasses with broad, flat leaf blades, sterile lemmas projecting as a tuft of short rigid awns from the top of the spikelet.

A small genus of forest grasses with 2 species in Tropical Asia and N. E. Australia.

Lophatherum gracile Brongn. in Dup. Voy. Bot. (1829) 50.

A loosely tufted perennial with fleshy roots. *Culms* erect or ascending from a geniculate base, slender to somewhat stout, 30-150 cm. tall, simple, glabrous and smooth. *Leaf-sheaths* loose, compressed and keeled, prominently striate, loosely hairy or glabrous; ligules very obscure, truncate, up to .5 mm. long, ciliolate; blades lanceolate to ovate, acute or acuminate, gradually or abruptly narrowed into a slender petiole-like base, up to 12 mm. long, flat, 10-25 cm. long, 12-32 mm. wide, thin, loosely hairy or glabrous, with fine longitudinal nerves and numerous transverse veinlets.

Panicle contracted or open, lax, 15-50 cm. long, composed of a few distant or clustered branches; rhachis slender, scaberulous; branches triquetrous, scaberulous, at length

spreading; pedicels reduced to minute stumps; spikelets acute, 6-12 mm. long, green. *Lower glume* 2·5-4 mm. long, 5-nerved, green with hyaline margins, minutely hairy at the base and shortly pilose on the margins. *Upper glume* similar to the lower but 5-7-nerved, glabrous, 3·5-5·5 mm. long. Fertile floret; lemma obtuse or minutely emarginate, 5-6·5 mm. long, 7-9-nerved, similar in texture to the glumes, glabrous with a straight rigid awn up to 2 mm. long; palea glabrous; 2-keeled, keels slightly winged. *Stamens* 3; lodicules absent. *Styles* connate at the base; stigmas long. *Caryopsis* oblong in shape, free. Sterile florets densely imbricate, each represented by an empty lemma terminating in a short, retrorsely-scabrid, short or recurved awn.

A forest grass common in the plains and hills up to 4,000 ft.

3. FESTUCEÆ.

Annual or perennial herbs; leaf-blades very narrow to lanceolate or rarely ovate, spikelets usually all alike, hermaphrodite rarely unisexual, 2 to many-(rarely 1-)flowered, laterally compressed, arranged in loose, contracted or spike-like panicles, rarely in spikes or racemes; rhachilla usually disarticulating above the glumes and between the florets, rarely below the glumes and the spikelets then falling entire; glumes persistent, similar, or the lower smaller, usually shorter than the lowest lemma; lemmas membranous to coriaceous, often herbaceous-membranous, usually 5 to many-(very rarely 3-) nerved, awnless or awned from the entire or 2-lobed tip, or just below the tip, rarely several-awned, the awn straight or curved, not geniculate; lodicules 2, rarely 3 or 0; stamens 3, rarely 2 or 1; caryopsis usually tightly enclosed between the lemma and palea.

Key to the genera of *Festuceæ*.

Inflorescence a simple terminal spike or raceme.

- Spikelets terete, racemes nodding. 1. *Brachypodium*.
Spikelets laterally compressed, spike erect. 2. *Lolium*.

Inflorescence a panicle.

All spikelets alike and fertile.

Glumes and lemmas muticous.

Panicles expanded; glumes and lemmas sub-equal 3. *Poa*.

Panicles narrow: glumes much shorter than the strongly nerved lemmas. 4. *Glyceria*.

Glumes and lemmas caudate, aristate or awned.

Spikelets in dense clusters. 5. *Dactylis*.

Spikelets not in clusters.

Lower glume much shorter than the upper. 6. *Vulpia*.

Lower and upper glume sub-equal.
Top of the ovary hairy-appendaged.

lemmas keeled. 7. *Bromus*.

Top of the ovary without an appendage, lemmas only keeled above. 8. *Festuca*.

Spikelets of two kinds, sterile and fertile. 9. *Cynosurus*.

1. BRACHYPODIUM Beauv.

Spikelets at first cylindric, then laterally compressed in simple racemes or false spikes with very short pedicels, with the flattened side to the axis; rhachilla glabrous, articulating above the glumes and between the florets. *Florets* 5 to many, hermaphrodite; the uppermost more or less reduced. *Glumes* more or less unequal, firm, strongly 3-7-nerved; lower often slightly a symmetric. *Lemmas* oblong to oblong-lanceolate usually narrowed into a straight awn, or mucronate, rounded on the back, closely imbricate at first, then more or less diverging and rolling inwards, 7-nerved, nerves prominent in the upper part faint below; callus very short, obtuse. *Palea* oblong, rather broad, very obtuse or truncate, slightly shorter than the lemma, 2-keeled; keels rigidly ciliate. *Lodicules* 2, lanceolate, usually ciliolate. *Stamens* 3, rarely 2. *Ovary* with a villous appendage at the top; styles laterally inserted on the appendage, very short; stigmas plumose, laterally exserted. *Caryopsis* linear or linear-oblong, convex-concave, adhering more or less to the palea; embryo small; hilum filiform, long.

Annual or perennial grasses with flat or setaceous convolute leaves. Inflorescence a terminal, simple, spiciform raceme: joints of axis more or less hollowed, at least the lower, opposite the spikelets.

Brachypodium sylvaticum. Beauv. Agrost. (1810) 101.

Culms up to 150 cm. high, smooth and glabrous, woolly or quiet glabrous at the nodes. *Leaves* 8-18 cm. long, up to 1 cm. broad, more or less villous and scaberulous, linear, flat, or flaccid or convolute, tapering to a fine point. *Sheaths* striate, more or less villous, often quite glabrous, hairy on the margins. *Ligule* prominent, blunt, fringed at the top.

Inflorescence a simple raceme of a few to numerous, shortly pedicelled or subsessile spikelets, which are cylindric at first, later on becoming compressed. *Racemes* up to 15 cm. long, nodding. *Glumes* two, usually unequal in size, the upper being the larger. *Lower glume* lanceolate, 3-5 mm.

long, and 1 mm. broad at the base, 5-nerved, tapering to a blunt tip. *Upper glume* 5 mm. long by 1.5 mm. broad, 7-nerved. *Florets* about 9. *Lowest lemma*, 3 mm. long by 2 mm. broad, broadly lanceolate, 7-nerved, awned from the entire tip, the scabrid awn being up to 8 mm. long: callus naked. The remaining lemmas diminish in size upwards and the last 1 or 2 are rudimentary, consisting merely of reduced lemma and awn, with or without a rudimentary palea. *Stamens* 3. *Ovary* with hairs on the top about the styles, this feature is not however apparent in young specimens. *Lodicules* 2, ciliolate.

KHASI HILLS and NAGA HILLS, BALIPARA FRONTIER TRACT, 6-10,000 ft.

Var. khasianum Hook. f. Distinguished from the type by the very long awns which may reach 3 cm. and by the hairy callus.

KHASI HILLS, 6,000 ft.

Var. wattii Hook. f. Rather stouter and more robust. The lower spikelets are pedicelled, the pedicel of the lowest spikelet is half as long as the spikelet or less, pubescent; awn about as long as the lemma.

NAGA HILLS. Japvo, 9,000 ft.

2. LOLIUM Linn.

Spikelets usually more or less compressed, 2-ranked, alternate, sessile in the hollows of the rhachis of a simple spike; rhachilla glabrous, disarticulating above the glumes and between the lemmas. *Spikelets* 3-11-or even more-flowered, hermaphrodite or the uppermost reduced. *Glumes* of terminal spikelets, equal and similar, lower suppressed on the lateral spikelets; upper linear to oblong, obtuse to acute, flat or slightly rounded, coriaceous, prominently 7-9-nerved. *Lemmas* oblong, rounded on the back, sub-obtuse, minutely 2-toothed (or acute in profile) more or less chartaceous except at the short hyaline tips, glabrous, 5-nerved, muticous or awned; awn a straight bristle from close to the tip. *Paleas* equalling the lemmas or nearly so, 2-keeled, keels more or less crested. *Stamens* 3. *Lodicules* 2, lanceolate with a lateral tooth. *Ovary* glabrous, truncate; style distinct, very short; stigmas laterally exserted, plumose. *Grain* elliptic-oblong to linear-oblong, tightly

enclosed by the lemma and palea, adhering to both; embryo short; hilum linear, almost as long as the grain.

Key to the species of *Lolium*.

Glume shorter than the spikelets; perennials.

Lemmas nearly or quite awnless. . . . 1. *L. perenne*.

Lemmas, at least the upper, awned. . . . 3. *L. temulentum*.

Glume as long as or longer than the spikelets:
annual. 2. *L. multiflorum*.

1. *Lolium perenne* Linn. Sp. Pl. (1753) 83.

A short-lived perennial grass with tufted stems; culms erect or decumbent at the base, 30-60 cm. tall; roots fibrous; leaves flat or convolute, slightly auricled at the base, dark green in colour, smooth and glossy on the undersurface, dull with distinct nerves above; blades linear to linear-lanceolate, up to 7 cm. long, 2-4 mm. wide; ligule short, membranous, truncate; sheaths close fitting when young, slipping from the culm when old, not keeled.

Inflorescence spicate; spikes terminal, simple, solitary; rhachis alternately and distichously hollowed out to contain the spikelets, smooth and glabrous. Spikelets solitary, 2-ranked, usually more or less compressed, the lowest lemma appressed to the rhachis, 3-11-or more-flowered. Glumes 2 in the terminal spikelet, the lower being suppressed in the other spikelets. Lower glume linear to oblong-lanceolate, obtuse, 5- or more-ribbed on the outside, thick, opaque, shorter than the spikelet. Upper glume (of all spikelets) similar in shape and texture, many ribbed or nerved, 7 mm. long. Lemmas chartaceous, oblong, shorter than the glumes, obtuse, acute or awned, 6 mm. long, rounded on the back 5-7-to more-nerved; paleas equal in length to the lemmas, truncate, 2-keeled; keels sometimes narrowly winged, minutely scabrid, margins infolded. Florets hermaphrodite or the uppermost imperfect. Lodicules 2. Stamens 3, 2.5 mm. long. Styles 2. Stigmas plumose. Grain elliptic to linear-oblong, tightly enclosed by and adhering to the lemma and palea.

A good fodder grass introduced into Shillong some years ago, where it has spread considerably.

2. *Lolium temulentum* Linn. Sp. Pl. (1753) 33.

An annual grass; culms fascicled or solitary, erect, rather stout, straight, 30-45 cm. tall, glabrous, rough, at least in the upper part, 2-4-noded; uppermost internode usually long exserted; leaves glabrous; sheaths rather tight, strongly striate; ligules very short, truncate; blades linear, acute, 15-30 cm. long, 5-7 mm. broad, rough all over or only on the upper surface and along the margins.

Spikes erect, 8-30 cm. long, with 10-20 spikelets; axis rather stout, slightly rough or smooth on the back; spikelets about the length of the internodes or the lower shorter and more distant, the upper more approximate, laterally compressed, 12-20 mm. long, 5-9-flowered; florets turgid; upper glume oblong, equaling or somewhat exceeding the uppermost floret, sub-obtuse to acute, very rigid, flat, glabrous and smooth, 7-9-nerved; lemmas elliptic-oblong, obtuse or sub-obtuse, muticous or usually awned, 7-8 mm. long, rounded on the back, herbaceous-chartaceous, smooth, 5-nerved, tip rather broad hyaline, obscurely 2-toothed; awn sub-terminal, straight, rather stout at the base, scaberulous, up to 20 mm. long; palea broad, keels green, stout; anthers over 2.5 mm. long; grain elliptic-oblong, semiterete, grooved in front, slightly shorter than the palea.

Introduced into Shillong in 1934.

3. *Lolium multiflorum* Lam. Flor. Franc. III (1878) 621.

An annual; culms fascicled, geniculate, ascending or erect, 20-45 cm. tall, glabrous, smooth or slightly rough in the upper part, 4-5-noded, internodes at length more or less exserted, simple or branched below; leaves glabrous; sheaths striate, smooth, lower sometimes purplish; ligule very short, truncate from an auricled base; blades linear, long tapering to a very slender point, 10-20 cm. long by 2.5-5 mm. broad, flat, somewhat rigid, scabrid on the upper surface and along the margins.

Spikes erect, 15-30 cm. long, made up of 12-30 spikelets; axis rather slender, smooth, scabrid on the margins; internodes (except the lowest) distinctly shorter than the

spikelets; spikelets laterally strongly compressed, elliptic-oblong, 15-20 mm. long, obliquely erect, 9-11-flowered, uppermost floret long exserted from the glume. *Upper glume* narrow, oblong, sub-obtuse, somewhat rounded on the back, equaling the contiguous floret or nearly so, strongly 7-nerved; lemmas awned or muticous, oblong 6.7-5 mm. long, sub-herbaceous-chartaceous, light green or ringed with purple above, 5-nerved, smooth; awn (when present) straight, very fine, 6-10 mm. long, close to the short, hyaline, minutely 2-toothed tip; keels of paleas green, crested, scabrid; anthers 3.5 mm. long; grain linear-oblong, semi-terete, 3-5 mm. long, deeply channelled in front, adhering to the lemma and palea.

Introduced into Shillong in 1934 with grass seed from southern Europe.

3. POA Linn.

Spikelets mostly 2-6-flowered, in loose or close (rarely spike-like) panicles; rhachilla articulating above the glumes and between the lemmas, glabrous or scantily and minutely hairy. *Florets* hermaphrodite or the upper imperfect. *Glumes* thin membranous, keeled, acute or obtuse, 1-3-nerved. *Lemmas* membranous, sometimes rather firm, obtuse or acute, 5-7-nerved, awnless; callus small obtuse, often with a tuft of long wool. *Paleas* shorter than the lemmas, 2-keeled. *Lodicules* 2, more or less 2-lobed. *Stamens* 3. *Ovary* glabrous, styles short, free; stigmas plumose, laterally exserted. *Caryopsis* ovoid, oblong, or linear, often grooved, free or adherent to the palea; hilum punctiform, basal; embryo small.

Annual or mostly perennials; a large genus found throughout the world in the cooler parts and on the high mountains of the tropics.

Key to the species of *Poa*.

Annuals.

- Ligules short; keels of palea scabrid. ... 1. *P. khasiana*.
- Ligules long; keels of palea ciliate. ... 2. *P. annua*.

Perennials.

Stoloniferous.

- | | |
|--------------------------------|--------------------------|
| Lower branches 5-nate. . . . | 3. <i>P. pratensis</i> . |
| Lower branches 2-3-nate. . . . | 4. <i>P. flexuosa</i> . |

Not stoloniferous.

Lemmas webbed at the base. . . . 5. *P. trivialis*.

Lemmas not webbed at the base. . . . 6. *P. alpina*.

1. *Poa khasiana* Stapf in Hook f. F. B. I. VII (1897) 343.

Culms 30-60 cm. sub-erect from a rooting base, loosely tufted, smooth and glabrous; internodes 5-6, upper gradually longer, terete, not branched. Leaf-blades linear, long-acuminate tapering to a rather blunt point, 10-16 cm. long, 2-2.5 mm. broad, flat, flaccid, glabrous, smooth or slightly scaberulous on the margins; sheaths smooth and glabrous, rather finely striate, tight, shorter than the internodes; ligule short, membranous, erose or truncate.

Panicle narrowly pyramidal, lower branches 3-5-nate; branches scaberulous, 10-18 cm. long, lax, sometimes sub-secund; lower branches sub-rigid or flexuous, slender, at length spreading or deflexed, unbranched except at the tips or loosely branched almost from the base. Spikelets 4-6 mm. long, ovate-oblong, pale green; lower glume firm, 2.25 mm. long, 1-nerved, keeled, rough; upper glume firm, rather longer and broader, 3-nerved; lemmas oblong, obtuse 3.3-5 mm. long; tip shortly hyaline; nerves 5, distant; keels and outer nerves sparsely silky or sub-glabrous; palea linear-oblong, obtuse, 2-keeled; keels scabrid, just over 2 mm. long; anthers 1.25 mm. long.

KHASI and NAGA HILLS above 5,000 ft.

2. *Poa annua* Linn. Sp. Pl. (1753) 68.

An annual or sub-perennial, tufted, glabrous; culms erect from a geniculate, often rooting base, from a few cms. up to 30 cm. tall, slightly compressed below, smooth; internodes exserted or enclosed; sheaths rather loose slightly compressed, smooth; ligules oblong to ovate, up to 3 mm. long; blades linear-acute 2 cm.—3.5 cm. long, rarely longer, 2.5 mm.—3.5 mm. broad, flat, flaccid; margins scaberulous.

Panicle rather stiff, ovate, or lax up to 8 cm. long, often sub-secund, the lower branches 2-(rarely 3-5)-nate or solitary, spreading, ultimately often deflexed, up to 3-5 mm.

long, branched from the middle, smooth. *Spikelets* more or less crowded, oblong, ovate or lower lanceolate, green or sometimes purplish, 5-6 mm. long, 3-7-flowered; lower glume lanceolate, acute, 2·5-3 mm. long, 1-nerved to sub-3-nerved; upper slightly longer, ovate when expanded, 3-nerved; lemmas oblong, obtuse or sub-acute, 3·7 mm. long; margins and tip broadly hyaline; nerves slightly prominent, silkily ciliate below along the keel and the outer side nerves, rarely glabrescent, without connecting wool (in the type); palea slightly shorter than the lemmas; keels ciliate; anthers 1 mm. long; caryopsis oblong 1·2-2·5 mm. long.

3. *Poa pratensis* Linn. Sp. Pl. (1753) 67.

A tall, stout, stoloniferous grass. *Culms* up to 40 cm. tall, smooth and terete. *Leaf-blades* usually flat, mostly collected at the base of the culms, firm or soft, upper leaves short, lower up to 20 cm. long, linear in shape, glabrous or sparsely hairy on the surfaces, margins rough: sheaths tight, smooth; ligule about 2 mm. long, truncate or sub-ovovate.

Inflorescence a lax or contracted panicle up to 12 cm. long, ovate or oblong, lower branches usually 5-nate, rarely 2-to 3-nate, naked below or rarely branched to the base, smooth or rough. *Spikelets* 4-5 mm. long, 3-5-flowered, ovate, acute, crowded, shortly pedicelled. *Lower glume* ovate-lanceolate, acute, 2·2-5 mm. long, 3-or 2-1-nerved, keel rough; margins hyaline, denticulate: upper glume rather larger, 3-nerved. *Lemmas* oblong, acute, 3-3·5 mm. long with prominent nerves, upper 1/5 or 1/6 hyaline; keel and lateral nerves silky to the middle or beyond: palea shorter than the lemma, keels scabrid-serrate; wool copious. Anthers 1·5-2 mm. long, linear.

BALIPARA FRONTIER TRACT, 10,000 ft.

Var. *alpigena* Blytt Norg. Flora, 130.

Balipara Frontier Tract, 9,000 ft., Kingdon-Ward.

4. *Poa flexuosa* Wahl. Flor. Carp. (1814) 22.

A small, tufted, slender stoloniferous grass. *Culms* 20-40 cm. tall, erect or geniculate at the base, smooth and

glaborus. Leaves narrowly linear-acute, or acuminate, flat, plicate or involute, 5-12.5 cm. long, glabrous, smooth or scaberulous, soft or rather firm; sheaths tight, lower scarious; ligule ovate, 2-4 mm. long.

Inflorescence a lax, pyramidal panicle, erect or nodding; lower branches capillary, flexuous, often spreading or deflexed, smooth, naked except towards the tips, 2-3-nate or solitary; pedicels scaberulous. *Spikelets* shortly pedicelled, 4.5 mm. long, green, usually suffused with purple. *Lower glume* 3.3-3.5 mm. long, thin, oblong-lanceolate, sub-obtuse or acute, 1-3-nerved, margins broadly hyaline, keel smooth or scaberulous; upper glume thin, rather longer than the lower, ovate-oblong, sub-obtuse or acute, 3-nerved, lateral nerves often short. *Lemmas* 4-5 mm. long, broadly oblong, hyaline at the tips, base shortly silky or glabrous; on the keel and nerves at the base, smooth or minutely scaberulous; palea rather shorter than the lemma, scabrid on the keels and dorsally most minutely puberulous between the keels; wool scanty or absent. Anthers 2.3 mm. long, linear.

BALIPARA FRONTIER TRACT, 9,000 ft., Kingdon-Ward.

5. *Poa trivialis* Linn. Sp. Pl. (1753) 67.

A glabrous, perennial, loosely tufted grass. *Culms* geniculate below, afterwards erect up to 60 cm. tall, terete or sub-compressed below, scabrid above, rarely smooth all along, about 3-noded. *Leaves* linear-acute 6-25 cm. long by 2.5-6.5 mm. wide, usually flat and flaccid, scaberulous; sheaths somewhat loose, striate, smooth or rough, the lower thin; ligules ovate-oblong, 4-6 mm. long.

Inflorescence an ovate to oblong, or even pyramidal panicle, 7.5-17.5 cm. long, erect or nodding; rachis usually smooth below; branches in distant semi-whorls of 4-6 (mostly of 5) unequal, filiform, scaberulous, the longest up to 7.5 cm. long and undivided for often more than half their length, distantly or closely branched, ultimate branchlets 2-6-spicate; lateral pedicels very short. *Spikelets* green or purplish, ovate to oblong, acute, 1.25-5 mm. long, 3-4-flowered; lower glume narrow, oblong, acute, scaberulous on the keel, 2.8-3.2 mm. long, 1-nerved; upper

glume ovate, acuminate, 3·75 mm. long, 3-nerved; side-nerves prominent; keel very scabrid. *Lemmas* oblong, acute, rather firm, lower 3·25 mm. long, pubescent along the keel to the middle, otherwise glabrous, side-nerves rather prominent; callus with a small tuft of very long wool; paleas 3 mm. long, 2-toothed; keels finely and very densely scabrid; anthers 2·5 mm. long: grain 1·25 mm. long, grooved.

Introduced into Shillong and escaped.

6. *Poa alpina* Linn. Sp. Pl. (1753) 67.

A densely tufted, usually low grass. *Culms* up to 35 cm. tall, terete, smooth. *Surculi* numerous at the base, clothed with short, distichous, thickish sheaths bearing firm, plicate-leaves with rough margins. Lowest sheaths of the stem distichous with thick bases enclosing the stem: upper sheaths much longer, smooth, open or not: leaves short, broadly linear, firm, acute; ligule of the lower and of the surculi leaves, very short, truncate, ciliolate, of the upper longer, ovate, somewhat coarsely denticulate.

Inflorescence a panicle broadly ovate in shape, 5 cm. long, but often small: usually dense, occasionally lax, lower branches mostly binate, more or less spreading, usually naked in the lower half: branchlets short, scaberulous. *Spikelets* crowded, variegated purple, brown and green, 4·6 mm. long, 3-6-flowered, broadly ovate in shape, lower short, upper long-pedicelled. *Lower glume* 3·5 mm. long, ovate-acute, margin broadly hyaline: upper similar but rather broader. *Lemmas* 3·3-5 mm. long, ovate-oblong obtuse, often emarginate, upper third hyaline, silky hairy below the middle, nerves obscure, wool absent; paleas hardly shorter 2-keeled; keels serrulate above the middle, ciliolate below. *Anthers* 1·5 mm. long.

BALIPARA FRONTIER TRACT, 10,000 ft.

4. GLYCERIA R. Br.

Spikelets few-to many-flowered, subterete or slightly compressed, in contracted or effuse panicles; rhachilla articulating above the glumes and between the florets. *Glumes*

unequal, persistent, hyaline, 1-5-nerved, obtuse or acute, usually scarios; lemma broadly oblong or fan-shaped, dorsally rounded, firm, usually obtuse, 3-9-nerved; nerves often obscure, vanishing below the broadly hyaline, obtuse, rounded (rarely acute) or truncate tip; keels of palea smooth or scaberulous. *Lodicules* 2, minute or well developed. *Stamens* 3. Style short, distinct. *Caryopsis* terete or compressed, free or sub-adherent to the palea.

Usually tall, aquatic or marsh perennials, with creeping and rooting bases or with creeping rhizomes, simple culms, closed or partly closed sheaths, flat blades and open or contracted panicles.

Key to the species of *Glyceria*.

- | | | | |
|---------------------------------------|----|----|---------------------------|
| Spikelets 4-flowered or less. | .. | .. | 1. <i>G. tonglensis</i> . |
| Spikelets 5-7-flowered. | .. | .. | 2. <i>G. fluitans</i> . |

1. *Glyceria tonglensis* C. B. Clarke in Journ. Linn. Soc. XV (1876) 119.

Stems prostrate and widely creeping in wet places, rooting at the nodes, rather tufted in drier habitats; culms slender, ascending, smooth and glabrous, 10-50 cm. long. *Leaf-blades* 10-30 cm. long, only 2-3 mm. broad, linear, flat, flaccid; tips obtuse or finely acute, glabrous and smooth on the surfaces, scaberulous on the margins: sheaths smooth and glabrous, finely striate, closed to the mouth; ligule membranous 2-3 mm. long, rounded or truncate, 2-auricled.

Inflorescence a raceme of peduncled spikelets sometimes as much as 30 cm. long, rachis slender, branches few-flowered. *Spikelets* pale green or purplish, rarely more than 4-flowered; rachilla flexuous, glabrous. *Lower glume* scarios, 2 mm. long, ovate-acute, 1-nerved; upper glume scarios, 2.75 mm. glabrous; margins irregularly lobed, 2-nerved or more. *Lemmas* 3 mm. long, chartaceous, ovate-oblong; tip rounded, hyaline, convex on the back, 7-nerved; nerves very prominent; palea hyaline as long as the lemmas or slightly shorter, 2-keeled, scaberulous on the keels, incurved. *Anthers* very small, linear-oblong. *Caryopsis* long, slender.

KHASI and JAINTIA HILLS in woods and marshes, 4-6,000 ft.

2. Glyceria fluitans (Linn.) R. Br., Prod. Fl. Nov. Holl. I (1810) 179.

A very elegant grass with a perennial root-stock, creeping extensively; culms weak, often spongy at the base, succulent, spreading widely, often floating with their lower leaves on the still surface of the water, 30 cm. to 2 m. long. *Leaf-blades* long, linear, roughish on both surfaces, radical ones flat, those of the stem folded; sheaths long, compressed, striated, smooth; ligules short, triangular, serrate.

Panicle simple, spreading or not, long, tapering; branches spreading and arching; the branchlets short and erect. *Spikelets* few, narrow, cylindrical, containing 5-7-ribbed florets usually variegated with green and white; the summit of the lowest lemma exceeds that of the glume. *Glumes* broadly oblong, the lower 2·2-5 mm. long, the upper 3·25-4·25 mm. long; lemmas broadly oblong the lowest 4·5-5·5 mm. long, membranous with a broadly hyaline tip, obovate or fan-shaped, rounded or truncate, rarely subacute, back rounded, 5-7-9-nerved; palea 2-keeled, 2-toothed, 2-nerved; keels narrowly winged upwards. Uppermost floret empty. *Lodicules* 2. *Stamens* 3. *Styles* 2, free.

In marshy places in and about Shillong, 4,500 ft., where it is found as an escape.

5. DACTYLIS Linn.

Spikelets laterally much compressed, very shortly pedicelled in dense compound, often secund clusters of a panicle or a false spike; rhachilla very tardily disarticulating above the glumes and between the lemmas or quite tough. *Spikelets* 3-7-flowered, hermaphrodite, or the uppermost rudimentary, exserted from the glumes. *Glumes* rigid, more or less hyaline, strongly keeled, sub-equal or the lower shorter, 1-3-nerved. *Lemmas* oblong, rigid, sub-herbaceous, mucronate or shortly awned, 5-nerved, keeled; keel ciliate; callus 0 or obscure. *Paleas* slightly shorter than the lemmas, 2-keeled. *Lodicules* 2, bilobed. *Stamens* 3. *Ovary* glabrous; styles distinct; stigmas plumose, laterally exserted. *Grain* enclosed by lemma and palea, oblong, strongly convex on the back, grooved in front, somewhat soft; embryo rather small; hilum punctiform, basal.

A temperate genus ascending to high altitudes in the tropics.

Dactylis glomerata Linn. Sp. Pl. I (1753) 71.

A perennial grass; culms shortly ascending, geniculate or not, tufted, from a short oblique rhizome, rather robust, 30-60 cm. high, simple, glabrous, smooth or slightly rough below the panicle, 2-3-noded; internodes more or less slightly exserted; leaves mostly crowded at the base, glabrous; sheaths tight, striate, lower more or less compressed and keeled (particularly those of the innovation shoots), pallid, sub-persistent or breaking up into fibres, upper terete, rough or almost smooth; ligules oblong, acute, up to 7.5 mm. long; blades linear, tapering to an acute point, 10-30 cm. long, or longer, 4-10 mm. broad, flat flaccid, rough on the upper surface and along the margins, striate.

Panicle erect, 2.5-15 cm. long; cluster of spikelets crowded into a dense (usually lobed) terminal false spike with or without 1-4 (rarely more) distant branches below it; these erect or spreading, straight or flexuous, terminated by similar clusters or groups of clusters; axis, branches and branchlets scabrid or pubescent in the upper part, the latter often minutely hispid or ciliate. *Spikelets* oblong, 6-10 mm. long, light green, often concave on the inner surface; *glumes* 2.5-5 mm. long, glabrous to pubescent; *lemmas* about 5 mm. long, tips obtuse, sides scaberulous to pubescent; mucro or awn up to 2.5 mm. long; *keels* of *palea* ciliate; *anthers* 3-3.5 mm. long; *caryopsis* 2.5-3 mm. long.

Introduced into Shillong in 1934 as a fodder grass. It is now common in the station.

6. VULPIA Gmelin.

Spikelets laterally compressed after flowering, 1-7-flowered; *rhachilla* slender, disarticulating at the base and between the fertile *lemmas*. *Glumes* very unequal, the lower minute or obsolete, or like the upper, subulate to subulate-lanceolate but much shorter, 1-nerved; the upper usually 3-nerved. *Lemmas* subulate-lanceolate, tapering into a

straight awn, back rounded, faintly 5-nerved: paleas entire or minutely 2-toothed, 2-keeled; lower one to several florets bisexual, the uppermost reduced. *Lodicules* 2, hyaline. Stamens 1-3. Styles 2, free. *Grain* linear, back strongly compressed, concave in front, enclosed within the lemma and palea, adhering to the latter or to both: embryo small.

Annual or perennial erect grasses. *Leaves* very narrow, involute or convolute. *Panicles* contracted narrow, spikelets usually more or less secund, seated on clavate pedicels.

Vulpia myuros (*Linn.*) *Gmel.*, Fl. Bad. I (1805) 8.
Syn. *Festuca myuros* Linn. Sp. Pl. (1753) 74.

An annual tufted grass with slender culms geniculate at the base, up to 30 cm. tall, glabrous, smooth. *Leaves* linear, tapering to an acute point, 2·5-15 cm. long by 1·25-2·5 mm. wide, flaccid or firm, puberulous or scabrid on the upper surface, otherwise glabrous and smooth; sheaths (particularly the upper) rather loose, smooth, glabrous; ligules very short, often obtusely auricled.

Inflorescence a spike-like panicle, erect or nodding and flexuous, narrow and often secund, 5-25 cm. long: rhachis filiform, acutely triquetrous, scabrid on the angles; branches fascicled or 2-nate and very unequal, or solitary, racemose from the base or the uppermost reduced to a solitary spikelet. *Spikelets* 8-12·5 mm. long, loosely 3-6-flowered. *Lower glume* reduced to a minute scale or subulate like the upper but much shorter than it, nerveless or 1-nerved; upper 3-5·3 mm. long, setaceous acuminate, 1-nerved. *Lemmas* linear-lanceolate, acuminate in profile: awn 7·5-25 mm. long, fine, scabrid; stamen 1; anthers 4-1 mm. long; grain 3-5 mm. long.

BALIPARA FRONTIER TRACT, 10,000 ft., Kingdon-Ward.

7. BROMUS Linn.

Spikelets laterally compressed, pedicelled on the branches of a loose or dense panicle, rhachilla disarticulating above the glumes and between the florets. *Florets* exserted from the glumes, usually numerous, hermaphrodite,

or the uppermost reduced. *Glumes* more or less unequal, acute to acuminate, persistent; lower 1-7-nerved; upper 3-9-nerved. *Lemmas* lanceolate to broadly oblong, entire or 2-toothed at the tip, rounded on the back or keeled, 5-13-nerved, usually awned; awn terminal or slightly distant from the tip (sub-terminal) straight or recurved but not geniculate. *Paleas* 2-keeled, with ciliate keels. *Lodicules* 2. *Stamens* 3. *Ovary* with a 2-3-lobed terminal hairy appendage. *Caryopsis* oblong or linear-oblong, usually adherent to the lemma and palea or to the latter only.

Annual or perennial grasses with linear flat leaf-blades, erect or nodding panicles and rather large spikelets.

A genus of wide distribution mainly in temperate regions.

Key to the species of *Bromus*.

Perennials.

- Awn as long as or shorter than the lemma. 1. *B. asper*.
- Awn longer than the lemma. 2. *B. himalaicus*.

Annuals.

- Spikelets often drooping, secund, long awned. 3. *B. tectorum*.
- Spikelets erect, not secund, short awned. 4. *B. unioloides*.

1. *Bromus asper* Murr., Prod. Stirp. Gotting. (1770) 42.

Culms 60 cm.-2 m., erect or ascending from a geniculate base, smooth, glabrous, striate, nodes villous or glabrous. *Leaf-blades* flat, flaccid, linear, tapering to a fine point, 30-45 cm. long, 4 mm. to 15 mm. wide, covered with scattered villae on the upper surface; undersurface glabrous but scaberulous, many nerved; margins scabrid; sheaths markedly striate, covered with retrorse hairs, margins often densely hairy; ligule short, obtuse and ciliate.

Inflorescence a nodding panicle up to 30 cm. long usually contracted but may be loose; rhachis stout below, scabrid or smooth, slender and angled above. *Branches* 2-nate or the lower 3-5-nate, up to 15 cm. long. *Spikelets* seated upon long or short, flexuous or straight, pedicels scarcely inflated at the tip, up to 3-5 cm. long, loosely 7-9-flowered. *Lower glume* lanceolate, 1-nerved, keeled and

scabrid on the keel, 1 cm. long. *Upper glume* lanceolate, 1·4 cm. long, strongly 3-nerved, the centre nerve being prolonged into short awn, scabrid on the nerves. *Lemmas* 1·5 cm. long, ovate-lanceolate, strongly 7-nerved, 2-lobed, the centre nerve issuing as an awn up to 1·5 cm. long, antrosely scabrid. *Palea* hyaline, 2-keeled and ciliate on the keels; margins infolded; rhachilla pubescent. *Stamens* 3; anthers 2 mm. long.

NAGA HILLS, Japvo, 9,800 ft.

2. *Bromus himalaicus* Stapf ex Hook. f. in F.B.I. VII (1897) 358.

A perennial grass erect from a very short root-stock. *Culms* up to 70 cm. tall. Leaves 15-25 cm. long by 3-7 mm. broad, linear, contracted below, tapering above to a fine acuminate point, pubescent on both surfaces, scabrid on the margins, many-nerved.

Inflorescence a panicle (very often reduced to a raceme) 15-24 cm. long; rhachis scaberulous or scabrous above, smooth below; branches 2-nate or the lower 3-5-nate, spreading or deflexed, unequal; lowest up to 7·5 cm. long, simple or sparingly divided. *Spikelets* up to 2·5 cm. long, linear-oblong in shape, green, loosely 9-flowered; rhachilla sub-scaberulous. *Lower glume* 5·7-5 mm. long, narrowly lanceolate, keeled on the back, 1-nerved; upper glume 7·5-8·5 mm. long, broader. *Lemmas* up to 1·25 mm. long, 5-7-nerved, rounded on the back, tip and margins hardly hyaline, glabrous, pubescent or rigidly hairy towards the margins; palea obtuse, 2-keeled, rigidly ciliate on the keels. *Anthers* 3, linear-oblong, 1·5-2 mm. long. *Grain* 5 mm. long, linear-oblong, plano-convex, adherent to the glume and palea.

BALIPARA FRONTIER TRACT, 10,000 ft.

3. *Bromus tectorum* Linn. Sp. Pl. (1753) 77.

An annual grass with culms up to 45 cm. tall, erect or ascending, glabrous or pubescent; leaf-blades 7·5 cm. long

by 3 mm. broad, linear, acute, flaccid, hairy; sheaths hairy, rarely glabrous; ligule ovate, lacerate.

Inflorescence a flaccid, nodding panicle, up to 12·5 cm. long: rhachis smooth or nearly so: branches 3-6-nate, capillary, flexuous, often decurved with erect tips, sparingly divided. *Spikelets* green, somewhat cuneiform in shape, 1·25-2·5 cm. long, green, loosely few-to many-flowered; rhachilla scabrid. *Lower glume* 5-8·5 mm. long, lanceolate, acute, 1-to (rarely) 3-nerved, tip and margins hyaline: upper glume 8-12·5 mm. long, oblong-lanceolate, 3-to 5-nerved. *Lemmas* from 12·5 mm. to nearly 17 mm. long, thin, oblong-lanceolate, acutely 2-fid, 5-7-nerved, puberulous or scabrid above or all over, tip and margins hyaline, awned from the tip or below it: awn up to 2 cm. long, straight or slightly curved: palea 2-keeled, long and loosely ciliate on the keel. *Anthers* 3, 1 mm. long. *Grain* 8-10 long, linear-oblong, dorsally compressed, ventrally concave or folded.

BALIPARA FRONTIER TRACT, 10,000 ft., Kingdon-Ward.

4. ***Bromus unioloides*** H.B.K., Nov. Gen. et Sp. I (1815) 151. Syn. *B. catharticus* Vahl, Symb. Bot. II (1791) 22.

An annual grass. *Culms* tufted, weak, erect or more often geniculately ascending; roots many, fibrous. *Leaves* linear, tapering to a fine point, up to 20 cm. long, 5 mm. wide, soft, flaccid, minutely scabrous or smooth, glabrous on both surfaces; margins cartilaginous, minutely toothed; sheaths tight, striate, glabrous and smooth or very minutely scaberulous; ligules membranous, 3-4 mm. long, convex or slightly erose.

Inflorescence a few-flowered lax panicle, rhachis and branches angled and scabrid; branches rarely divided, increasing slightly in diameter from below upwards, each crowned with a solitary spikelet. *Spikelets* ovate to ovate-lanceolate, up to 2·5 cm. long by 7 mm. broad, 3-6-flowered: lower glume 5-6-nerved, lanceolate, margins scarious, tip blunt, 7·5 mm. long, keeled and scabrid on the keels; upper glume 9-10 mm. long, 9-nerved, tip blunt, keel scabrid; lemmas 12-15 mm. long, broadly lanceolate, chartaceous,

creamy-white in the lower two-thirds, pale green above, 11-13-nerved; callus naked, scabrid on the nerves on the dorsal surface, shortly awned; rhachilla triangular in section, ciliate on the frontal angle, produced and crowned with a sterile floret: palea 4-10 mm. long, 2-keeled, scabrid on the keels. *Grain* narrowly ellipsoidal, 6 mm. long.

This species has been identified with the earlier *B. catharticus* Vahl but the latter is a very dubious species. A native of temperate South America it is now widely spread throughout the tropics. An important fodder grass.

Found in Laban, Shillong, KHASIA & JAINTIA HILLS, 5,000 ft. Probably introduced.

8. FESTUCA Linn.

Spikelets laterally compressed, frequently curved, pedicelled on the branches of open or contracted panicles; rhachilla disarticulating above the glumes and between the florets. *Florets* 2 to many, exserted from the glumes, hermaphrodite or the uppermost reduced. *Glumes* usually nearly equal, acute, keeled, membranous 1-8-(rarely 5)-nerved. *Lemmas* lanceolate to lanceolate-oblong, awnless, mucronate or with a straight awn from the tip, membranous or rigid, rounded on the back or keeled towards the apex, 5-7-nerved. *Palea* 2-keeled. *Lodicules* 2. *Stamens* 3. *Ovary* glabrous or minutely pubescent at the top. *Caryopsis* tightly enclosed by the lemma and palea, oblong.

Tufted perennials with flat, folded or rolled leaf-blades. A large genus with numerous species.

Key to the species *Festuca*.

Vernation of all leaves conduplicate :—

- | | | |
|---------------------------------|----|--------------------------|
| Lemmas dull; culms upto 30 cm. | .. | 1. <i>F. valesiaca</i> . |
| Lemmas shining; culms 45-60 cm. | .. | 2. <i>F. rubra</i> . |

Vernation of leaves convolute :—

Awn twice as long as the lemma :—

- | | | | |
|-----------------|----|----|-------------------------|
| Ovary glabrous. | .. | .. | 3. <i>F. gigantea</i> . |
|-----------------|----|----|-------------------------|

Awn about equal to the lemma :—

- | | | | |
|--------------------|----|----|---------------------------|
| Ovary hispidulous. | .. | .. | 4. <i>F. leptopogon</i> . |
|--------------------|----|----|---------------------------|

1. *Festuca valesiaca* Schleich. ex Gaud. Agrost. Helvet. I (1828) 242.

A tufted perennial. *Culms* up to 30 cm. tall, nodes 2, both in the lower portion, slender, rigid, erect. *Leaf-blades*

5-15 cm. long, setaceous, green or glaucous in colour, smooth, ridged; sheaths of innovations, tight, smooth, open to near the base, persistent; ligule short, obscurely auricled.

Inflorescence a short, stiff, contracted panicle. *Branches* erect, solitary or 2-nate. *Spikelets* 4-5 mm. long, 3-4-flowered, oblong, broadly ovate when open, pale green or purplish, seated on short pedicels. *Lower glume* lanceolate, acute or sub-acute, 1.25-1.5 mm. long. *Upper glume* similar in shape, about 3 mm. long. *Lemmas* 3-4 mm. long, 5-nerved, pruinose, smooth or scaberulous, awned; awn shorter than the lemma; palea oblong-lanceolate, 2-toothed, scabrid on the keels. *Ovary* glabrous. *Anthers* .75-1.5 mm. long. *Lodicules* 2, minute, obliquely ovoid. *Grain* 1.5 mm. long, ventrally grooved, adherent to the palea and often to the lemma.

BALIPARA FRONTIER TRACT, 9,000 ft., Kingdon-Ward.

2. *Festuca rubra* Linn. Sp. Pl. (1753) 54.

Culms ascending from a geniculate base or erect, striate, smooth, internodes 2. Extravaginal innovations are frequent, either ascending or stoloniferous. *Leaf-blades* setaceous, 8-12 cm. long, (cauline leaves linear and flat), rather thick, green, 3-7-nerved, sub-acute, or almost obtuse, smooth; sheaths of innovations tight, closed almost to the mouth, smooth; those of the flowering stem split; *ligule* very short, truncate, ex-auricled.

Inflorescence a panicle 8-12 cm. long, very variable, narrow, nodding and secund or erect, rather dense and ovate, rhachis scabrid; branches solitary or lowest binate, divided from or near the base; spikelets 10 cm. to 1.6 cm. long, oblong, loose, 4-9-flowered, green or variegated, glabrous or hairy and ciliate. *Lower glume* lanceolate, acuminate, 1-nerved, nerve percurrent or sub-excurrent, 9 mm. long; upper glume 8 mm., ovate-lanceolate; lemmas strongly involute, oblong-lanceolate, margins above broadly hyaline, faintly 5-nerved, awned; awn up to 2.5 mm. slender; palea equalling the corresponding glume in length linear-oblong, shortly 2-fid; keels ciliolate. *Lodicules* obliquely ovate, sub-2-lobed. *Anthers* 2.3 mm. long. *Ovary* glabrous, save

for 1 or 2 hairs. *Grain* 3·5 mm. linear-oblong, grooved, sometimes adherent to both lemma and palea; hilum rarely equal to the grain in length.

KHASI HILLS, 5,600 ft.

Var. Clarkei Stapf.

Extravaginal innovations very rare, slender; leaves sub-setaceous; caudine rarely flat, panicle 7·5 cm.-12·5 cm. nodding; branches few sub-second; lowest up to 7·5 cm. rigid or flexuous, mostly obliquely erect; spikelets 1·25 cm. pale green; lower glume 5 mm.; upper glume 6 mm.; lemmas 6·7·5 mm.; awn up to 6 mm. *Anthers* 1·3·5 mm.; grain 3·5 mm. long.

KHASI HILLS, 5,600 ft.

3. *Festuca gigantea* Vill., Hist. Pl. Dauph. II (1786) 110.

A perennial grass with loosely tufted stems. *Culms* 60-80 cm. tall from a short rootstock with fibrous roots, smooth, with 3-5-nodes. *Leaves* 12·5-30 cm. long, amplexicaul, linear to linear-lanceolate, tapering to a fine acuminate point, smooth and glabrous, scaberulous on the margins; sheaths smooth, terete; ligule very short, truncate, glabrous.

Inflorescence an ovate or oblong-ovate panicle, 10-35 cm. long, nodding; branches solitary or the lower 2-nate, spreading, flexuous, scabrid; branchlets few-spiculate, spreading or appressed, pedicels short or the lower sometimes equal to the spikelet in length. *Spikelets* linear-lanceolate in shape, about 1·25 cm. long, pale green in colour. *Lower glume* membranous 2·5-3·5 mm. long, subulate-lanceolate, 1-nerved or obscurely 3-nerved at the base, margins white hyaline. *Upper glume* membranous, lanceolate, 3-nerved. *Lemmas* 7·5-8 mm. long, oblong-lanceolate, acute, or the tip shortly bifid, margins narrowly hyaline, minutely puberulous below the tip, nerves faint, awned; awn sub-terminal, straight or flexuous, twice as long as the lemma; palea oblong-lanceolate, 2-toothed, keels minutely scaberulous. *Anthers* 2·5-3·5 mm. long. *Grain* 5 mm. long, tightly adherent to the palea.

BALIPARA FRONTIER TRACT, 9,000 ft., Kingdon-Ward.

V. 5—6

4. *Festuea leptopogon* Stapf ex Hook. f., F.B.I. VII (1897) 354.

A tufted perennial; root-stock short, roots fibrous. *Culms* 60-120 cm. high. *Leaves* 4-30 cm. long, linear, finely acuminate, flat, dark green, many nerved; base rounded; margins hardly scabridulous. *Ligule* up to 3 mm. long, truncate.

Inflorescence a panicle 15-30 cm. long, open or contracted, erect or nodding; branches scabrid, distant, dividing from near the base; branchlets few, distant, more or less appressed, lateral pedicels very short. *Spikelets* 2-3-flowered, linear-lanceolate; rhachilla scabrid, disarticulating above the glumes and between the florets. *Lower glume* wedge-shaped, 1.1-1.5 mm., 1-nerved, with narrow hyaline margins. *Upper glume* 2.5 mm., 3 nerved, with hyaline margins, ovate-oblong with a blunt tip, minutely scabrid on the dorsal nerve below the tip. *Lemmas* 7-8 mm. long, 5-nerved, 2-lobed at the apex, glabrous except for a minute pubescence below the 2 acute lobes, hyaline on the margins. A straight scabrid awn 7 mm. long issues from the sinus. *Palea* glabrous 2-keeled, very minutely scabrid on the keels, as long as or slightly longer than the corresponding lemma. *Lodicules* 2, 2-horned. *Anthers* 1 mm. long. *Ovary* minutely hispidulous on top. *Grain* 3.5 mm. long, linear-oblong, free or adherent to the base of the palea; top hispid; groove shallow.

KHASI HILLS, 5-6,000 ft. NAGA HILLS, 7,000 ft.

9. *CYNOSURUS* Linn.

Spikelets of two kinds, fascicled, collected in a dense unilateral, spiciform, terminal panicle, sterile and fertile together; fertile spikelets nearly covered by the sterile; sterile spikelets consisting of two glumes and several narrow, acuminate, 1-nerved lemmas on a continuous rhachilla: fertile spikelets 2-3-flowered, the glumes narrow, the lemmas broader, rounded on the back, tipped with a short awn, the rhachilla disarticulating above the glumes.

Annual or perennial tufted grasses with narrow flat

leaves and dense spike-like panicles. *Lodicules* 2, acuminate. *Stamens* 3. *Styles* short, free.

Temperate grasses often found at high altitudes in the tropics.

Cynostetus cristatus Linn. Sp. Pl. (1753) 72.

A perennial grass; culms 30-60 cm. tall, tufted, somewhat flattened or sub-terete, erect or geniculate at the base, smooth and glabrous; sheaths somewhat loose, striate, often slightly keeled, shorter than the internodes, smooth and glabrous; leaf-blades lanceolate-acuminate, narrow, up to 10 cm. long, 3 mm. wide, smooth, glabrous, midrib distinct; ligules oblong, truncate, membranous, 1.5 mm. long.

Inflorescence a spike-like panicle on a sinuate rachis, 3-8 cm. long. *Spikelets* in pairs imbricate, secund, the pedicelled sterile and covering the sessile fertile spikelets. *Sterile spikelets* consisting of 2 glumes and several narrow, 1-nerved lemmas on a sinuate continuous rhachilla. *Fertile spikelets* several-flowered on an articulate rhachilla continuous beyond the uppermost fertile floret and surmounted by a rudimentary floret. *Lower glume* 4.5 mm. long, lanceolate, acuminate, sharply keeled, strongly 1-nerved, aristate, scabrid on the keel. *Upper glume* 5 mm. long, similar in shape. *Lemmas* ovate-acute, 5-nerved, rounded on the back and scabrid, 4.5-5 mm. long, awn 1 mm. long; palea hyaline with 2 parallel nerves, scabrid on the keels. *Stamens* 3. 2.5 mm. long.

Introduced into Shillong as a fodder grass and now often found as an escape.

4. HORDEÆ.

Annual or perennial herbs; leaf-sheaths usually with small auricles at the mouth; blades narrow; spikelets 1-to many-flowered, solitary or in clusters of 2 to 6, mostly hermaphrodite and sessile, or the lateral spikelets of a cluster sometimes shortly pedicelled and male or barren, alternating on opposite sides of the continuous or jointed rachis of solitary spikes or spike-like racemes; rachilla disarticulating above the glumes and between the florets or continuous in cultivated races; glumes well developed; lemmas at length indurated, 5-to 9-nerved, awnless or awned from the tip; lodicules 2; stamens 3; styles 2; caryopsis free or adhering to the lemma or palea.

Key to the genera of Hordeæ.

- | | | |
|------------------------------------------|----|----------------------|
| Spikelets solitary, 2- or more-flowered. | .. | 1. <i>Triticum</i> . |
| Spikelets in threes, 1-flowered. | .. | 2. <i>Hordeum</i> . |

1. TRITICUM Linn.

Spikes terminal, solitary; rachis excavated opposite the spikelets, articulate or inarticulate. Spikelets solitary, distichous, tumid, few flowered. Glumes two, persistent, rigid, often unequal-sided, obtuse or shortly awned. Lemmas oblong or ventricose, back rounded or keeled upwards, muticous or 1-to 3-awned, 5-9-nerved; paleas as long, 2-keeled; keels ciliate. Lower floret hermaphrodite, upper male or barren. Lodicules 2. Stamens 3. Styles 2.

Grain oblong, ventrally grooved, often hairy, free within the lemma and palea or adhering to the latter.

Annual or perennial (biennial) herbs, often tufted, with flat leaves and thick spikes.

Triticum aestivum Linn. Sp. Pl. (1753) 85.

An annual herb with fibrous roots. Culms 80-150 cm. tall, erect or tufted, smooth, hollow or sometimes solid

above. *Leaves* flat, linear-lanceolate or broadly linear, acuminate, somewhat rough; sheaths smooth; ligules short, truncate.

Inflorescence an erect spike, curved at maturity, irregularly four-sided, more or less compact, rarely somewhat loose: rhachis continuous, hairy on the margins. *Spikelets* solitary, imbricate on the opposite sides of the rhachis, laterally compressed, ovoid, glabrous or hairy, whitish or reddish, 3-5-flowered, more often four, the uppermost sterile. *Glumes* about 1 cm. long, sub-equal, broad, ovate, oblong, persistent, rigid, unequal-sided, obtuse or shortly awned. *Lemmas* oblong, ventricose, back rounded or keeled upwards, muticous or 1-3-awned, hermaphrodite; paleas as long as the lemmas, 2-keeled, keels ciliate. *Lodicules* 2. *Stamens* 3. *Grain* oblong, ventrally grooved, free within the lemma and palea or adhering to the latter.

The wheat plant is cultivated by the Sherdukpen, BALIPARA FRONTIER TRACT, 6,000 ft.

2. HORDEUM Linn.

Spikelets in groups of three at the nodes of the disarticulating (except in cultivated forms) rhachis of a dense spike; rhachilla tough, produced as a bristle beyond the floret, sometimes bearing a rudimentary lemma. *Floret* hermaphrodite in the intermediate spikelet, male or barren (hermaphrodite sometimes in cultivated races) in the lateral. *Glumes* subulate or bristle-like or narrowly linear and awned, rigid, 1-3-nerved, persistent, more or less collateral and together forming a kind of involucre. *Lemmas* lanceolate, sub-involute, rounded on the back, gradually produced into a bristle-like awn, 5-nerved. *Palea* about as long as the lemma, (exclusive of the awn), 2-keeled, narrowed, deeply folded between the keels. *Lodicules* 2, lanceolate, ciliate or ciliolate, hyaline. *Stamens* 2. *Ovary* villous at the top; style very short terminal; stigmas laterally exserted, plumose; caryopsis tightly enclosed and usually adhering to the lemma and palea, ovoid-oblong or narrow-oblong, rounded on the back, grooved in front; embryo short; hilum filiform, very long.

***Hordeum vulgare* Linn., Sp. Pl. (1753) 84.**

An annual herb with fibrous roots. *Culms* 60-120 cm. tall, erect, glabrous. *Leaves* linear, flat, elongate, broad, scaberulous, with two auricles at the base; sheaths loose glabrous, striate; ligule short, truncate.

Inflorescence a spike, 2-10 cm. long, erect at first, afterwards curved, somewhat compressed, irregularly four-sided. *Spikelets* in threes seated in the cavities of the inarticulate rhachis, 1-flowered or the lateral imperfect; rhachilla jointed below the lemma and produced into a short pubescent or scabrid stipe. *Glumes* two, persistent, rigid, narrow, the outer of each cluster together often resembling an involucre. *Lemma* lanceolate up to 1 cm. long, rounded on the back, 5-nerved, tapering into a long straight or recurved awn: palea as long as the lemma, deeply folded between the keels. *Floret* hermaphrodite in the centre spikelet, hermaphrodite or male in the lateral spikelets. *Lodicules* 2. *Stamens* 3. *Grain* ovoid or narrowly oblong, grooved in front, tip usually villous, tightly enclosed in the lemma and palea and adhering to the latter or to both: embryo small.

The Barley plant. Occasionally cultivated in the BALIPARA FRONTIER TRACT and found as an escape in Shillong. 4-6,000 ft.

5. ARUNDINEÆ.

Perennials, usually with tall, stout, sometimes woody culms; leaf-blades long and flat; spikelets hermaphrodite, or unisexual with the sexes on different plants, 2-to 10-flowered, arranged in often large panicles; rhachilla disarticulating above the glumes or lowest floret and between the florets; glumes hyaline or membranous, similar or the lower smaller; lemmas somewhat similar to the glumes, acuminate, awnless or awned from the tip, 1-to 5 (rarely more)-nerved, enveloped by long hairs either from the rhachilla or from the back of the lemmas (at least in the fertile florets); lodicules 2; stamens 2 to 3.

Key to the genera of *Arundineæ*.

Spikelets hermaphrodite:—

- | | | |
|--------------------------------------|----|------------------------|
| Lemmas glabrous; rhachilla bearded. | .. | 1. <i>Phragmites</i> . |
| Lemmas with silky hairs on the back. | .. | 2. <i>Arundo</i> . |
| Spikelets unisexual. | .. | 3. <i>Cortaderia</i> . |

1. PHRAGMITES Trin.

Spikelets loosely 3-10-flowered, awnless, in large panicles; rhachilla disarticulating above the lowest and between the following lemmas, slender, glabrous, joints very short; lowest floret male or abortive; the following hermaphrodite, the uppermost reduced. *Glumes* thin, unequal to sub-equal, lanceolate, acute, more or less rounded on the back, 3-nerved, or the lowest sometimes sub-nerved. *Lemmas* heteromorphous, the lowest linear-lanceolate, much longer than the subtending glume, otherwise of a similar structure, quite glabrous, persistent, the following lemmas very thin, linear, long and more or less caudate-acuminate, 3-nerved; middle nerve percurrent; side nerves fine, short; callus long, slender, with very long silky-hairs. *Palea* linear-oblong about 1/2 the length of the lemmas, 2-keeled. *Lodicules* 2 (or sometimes 3 in the lowest floret) obovate, 2-3-nerved, glabrous. *Stamens* 3, or 2 in the lowest floret. *Ovary* glabrous; in the

lowest floret rudimentary or quite suppressed; style distinct, rather short; stigmas laterally exserted, densely plumose. *Caryopsis* loosely enclosed by the lemma and palea, free, oblong, semiterete; hilum oblong, short, basal; embryo about half as long as the grain.

Perennials with creeping rhizomes, extravaginal innovation shoots, and tall, sheathed, annual or perennial culms; blades flat; ligule a narrow, ciliate, membranous rim; panicle lax, usually very large and much compound; spikelets conspicuously silvery from the long callus hairs.

Phragmites karka Trin. ex Steud., Nom. Ed. II 324.

A very large and tall grass up to 7 m. with rather close, jointed, hollow stems, spreading widely by means of stolons. Leaves distichous, linear to broadly lanceolate, tip subulate; ligule a ridge of short stiff hairs.

Inflorescence a large decompound panicle, 15-60 cm. long, by 10-40 cm. broad, very silvery-hairy at the base, branches filiform, distinctly scaberulous; pedicels glabrous. *Spikelets* several-flowered, 1·1-1·8 cm. long. *Lower glume* oblong-lanceolate, membranous, 3-5-nerved. *Upper glume* 5 mm. long, 3 nerved, oblong-lanceolate, membranous. *Lowest lemma* up to 12·5 mm. long, narrowly oblong-lanceolate, acute, convolute, 3-nerved, male or neuter, persistent. *Upper lemmas* subulate-lanceolate, sub-aristate, successively a little shorter than the lower; paleas much shorter than the lemmas, to 3 mm. long, faintly 2-nerved, glabrous, ending in two short horns or tip obtuse. *Stamens* 1-3. *Styles* 2, terminal, free, stigmas plumose. *Lodicules* 2, obtuse. *Rhachilla* above the lowest lemma penicillate with long white hairs.

Very common in wet places all over the plains and ascending in the hills up to 4,000 ft.

Var. *cineta* Hook. f.

This variety, which is distinguished from the type by possessing long villous pedicels, is found near Kohima, NAGA HILLS, 5,000 ft.

2. ARUNDO Linn.

Spikelets 2-7-flowered, laterally compressed, in very compound panicles; rhachilla disarticulating above the

glumes and between the lemmas; joints short, glabrous; florets hermaphrodite, the uppermost reduced. *Glumes* equal, broadly lanceolate, shortly acuminate, keeled, membranous, 3-5-nerved. *Lemmas* more or less equalling the glumes, ovate to lanceolate-ovate, acuminate, finely bifid or entire, long hairy below, 5-9-nerved, 3 nerves more or less percurrent or excurrent, the rest short, the middle nerve often produced into a short fine bristle; callus short, shortly bearded. *Paleas* slightly exceeding half the length of the lemma, 2-keeled. *Lodicules* 2, obovate, nerved, glabrous. *Stamens* 3. *Ovary* glabrous; style distinct, almost as long as the laterally exserted plumose stigmas. *Caryopsis* ovoid-oblong; broad, loosely enclosed by the lemma and palea; hilum basal, punctiform; embryo almost wholly one side of the grain.

Perennial with creeping rhizomes, extravaginal shoots, and very tall and stout culms; sheaths slightly exceeding the internodes; leaves rather evenly distributed over the culms; blades long, broad, flat; ligules very short, membranous.

Arundo Donax Linn., Sp. Pl. (1753) 31.

Culms erect from a creeping rhizome 2-6 m. high, stout, many noded, simple or branched, glabrous and smooth, or slightly rough towards the tips of the blades, numerous and evenly distributed along the culm; blades linear-lanceolate, tapering to a very fine point, 30-60 cm. long, 2-7 cm. wide, more or less drooping.

Inflorescence a large terminal de-compound plumose panicle, 30-60 cm. long, erect; branches scaberulous, erect or drooping. *Spikelets* 3-10 mm. long, light-brown in colour, 2-7-flowered, laterally compressed; rhachilla disarticulating above the glumes and between the florets; joints short, glabrous. *Lower and upper glumes* sub-equal, broadly lanceolate-acuminate, glabrous, keeled on the back, 3-5-nerved. *Lemmas* 6-10 mm. long, as long as the glumes, ovate to ovate-lanceolate in shape, acuminate, 2-toothed or entire, 5-9-nerved, middle nerve produced into a short arista, long hairy on the back in the lower half, hairs 5-6 mm. long; callus short, sparsely bearded.

ed. *Palea* about half the length of the lemma. 2-nerved, 2-keeled. *Lodicules* 2, obovate, glabrous. *Stamens* 3; anthers 3 mm. long. *Ovary* glabrous; styles distinct, almost as long as the laterally exserted plumose stigmas. *Grain* 2.5 mm. long.

Common. Hills and plains.

3. CORTADERIA Stapf.

Spikelets 12-14 mm. long, naked, on flexuous and slightly scabrous pedicels usually shorter than the spikelet, numerous, 2-4-flowered. *Glumes* 8-12 mm. long, the lower slightly shorter than the upper, narrow, 1-nerved, papery, thin attenuate into a rather long point, mostly 2-toothed. *Lemma* 3-nerved, hyaline, narrow, glabrous in male plants, villous in female plants, 6-7 mm. long, awned: awn 4-5 mm. long. *Palea* 4 mm. long, hyaline, sub-2-keeled, pubescent at apex.

Dioecious grasses. *Culms* tall tufted; blades long, narrow, mostly basal; margins rough. *Panicle* included or exserted, up to 75 cm. long, oblong, pyramidal, feathery, silvery-white or pink; axis smooth, branches whorled or one-half whorled and one long branched; branchlets numerous, spiculate nearly to the base.

***Cortaderia selloana* (Schult.) Aschers. et Graeb.**
Syn. Mitteleur. Flor. II (1900) 325.

A dioecious perennial reed growing in large tufts. *Culms* erect, stout, up to 3 m. tall. *Panicle* plumose, silvery or pink, 40-100 cm. long. *Spikelets* 2-3-flowered, the female with long silky hairs, the male naked: *Glumes* white, papery, long, slender. *Lemmas* with a long slender awn.

Introduced and grown for ornament.

6. ERAGROSTEÆ.

Annual or perennial herbs; leaf-blades narrow; spikelets 2-to many-flowered, mostly hermaphrodite, usually laterally compressed, pedicelled in open or contracted panicles, or secund and sessile or sub-sessile in spikes or spike-like racemes; rhachilla usually disarticulating above the glumes and between the florets, rarely persistent or disarticulating below the glumes and the spikelets then falling entire; glumes usually persistent, membranous to coriaceous, usually shorter than the lowest lemma; lemmas mostly exserted from the glumes, rarely enclosed by them, membranous to coriaceous, scarcely changed at maturity, 1-to 3-nerved, entire, emarginate or 2-to 4-lobed at the tip, awnless, mucronate or with a straight awn from the tip or sinus, rarely with the three nerves running out into awns; lodicules 2; stamens 2 or 3; grain loosely or tightly enclosed by the lemma and palea, sometimes with a free pericarp.

Key to the genera of *Eragrosteeæ*.

Lemmas entire or minutely lobed at the apex :—

- Lemmas awned from the tip; spikelets in spike-like panicles. 1. *Elytrophorus*.
Lemmas awnless, or if awned spikelets not as above :—
- Spikelets in loose or contracted panicles :—
Upper glume 3-nerved. 2. *Eragrostis*.
Upper glume 1-nerved. 3. *Desmostachya*.
Spikelets in spikes or spike-like racemes :—
Spikes solitary, terminal. 4. *Eragrostiella*.
Spikes not solitary :—
Spikes usually digitate; grains with free pericarp :—
Axis terminating in a spikelet. 5. *Eleusine*.
Axis terminating in a muero. 6. *Dactyloctenium*.
Spikes racemosely arranged; grains with adnate pericarp. 7. *Leptochloa*.
Lemmas deeply lobed at the tip, usually awned :—
Spikelets in solitary spikes. 8. *Tripogon*.
Spikelets in panicles. 9. *Neyraudia*.

I. ELYTROPHORUS Beauv.

Spikelets laterally compressed, small, awned, sessile in dense, globular to oblong clusters on the branches of a continuous or interrupted, lobed, false spike; rhachilla disarticulating above the glumes and between the lemmas, glabrous. *Florets* 2-7 (mostly 3 or 4) shortly exserted or included within the glumes, hermaphrodite or the upper reduced. *Glumes* persistent, nearly equal or the upper slightly longer, keeled, narrow, mucronate, membranous, 1-nerved.

Lemmas similar to the glumes, mucronate or shortly awned from the entire tip, 3-nerved, membranous. *Palea* shorter than the lemmas, 2-keeled with both keels, or only one, broadly winged. *Lodicules* 2. *Stamens* 1-3, minute. *Ovary* glabrous. *Caryopsis* free between the lemma and palea.

An annual grass with flat leaf-blades and cylindrical or lobed spike-like panicles.

Elytrophorus spicatus A Camus in Lecomte, Flor. Gen. de l'Indo-Chine VII. 547. Syn. *E. articulatus* Beauv. Agrost. (1812) 67, t. 14, f. 2.

Annual. *Culms* tufted, erect or geniculate at the base, 12-60 cm. high, slender, simple or branched, up to 4-noded, minutely pubescent or glabrous and smooth. *Leaf-blades* linear, acute, 2-24 cm. long, 1.5-5 mm. wide, flat and slightly rough, glabrous or with a few scattered hairs below; *leaf-sheaths* thin, loose, glabrous and smooth; *ligule* truncate, up to 1 mm. long, thin, glabrous.

Inflorescence a narrow, continuous, or more or less interrupted (especially downward) false spike 5-34 cm. long, bristly, up to 1 cm. wide (including the bristles), cylindrical, green or straw-coloured; rhachilla scaberulous or densely and minutely pubescent; branches erect, densely spiculate to the base, forming dense, globular, ovoid or oblong clusters of spikelets, the lower 5-2.5 cm. long and distant by 1.5 cm.; the upper shorter and closer together or contiguous. *Spikelets* 2-4 mm. long. *Glumes* lanceolate, finely acute, shortly mucronate, including the mucro

1·8-3 mm. long, ciliolate on the margins. *Lemmas* lanceolate 1·2-·5 mm. (mostly 2-·5 mm.) long, tapering into a curved or straight bristle, up to 2 mm. long, ciliolate; *paleas* ·8-·2 mm. long, wings up to ·4 mm. wide and toothed or ciliate. *Anthers* ·4 mm. long. *Caryopsis* ·6-·8 mm. long.

Nongkhlow, KHASI & JAITIA HILLS, 4,000 ft. and Haltugaon, GOALPARA 500 ft. Plains of SYLHET.

2. ERAGROSTIS Beauv.

Spikelets laterally compressed, rarely terete, awnless, pedicelled on the branches of open or contracted panicles; rhachilla disarticulating above the glumes and between the lemmas, or tough and persistent, rarely falling entire, glabrous, rarely minutely hairy. *Florets* 2 to many, hermaphrodite or the upper reduced, exserted from the glumes. Glumes equal or unequal, membranous, 1-nerved or the upper 3-nerved. *Lemmas* loosely to densely imbricate, acute or obtuse, entire, awnless, membranous to thinly coriaceous, 3-nerved, glabrous or very rarely hairy; *paleas* as long as or shorter than the lemmas, 2-keeled, deciduous or persistent with the rhachilla. *Lodicules* 2. *Stamens* 3 or 2. *Ovary* glabrous. *Grain* linear-oblong to globose or ovoid, enclosed by the lemma and palea and falling with the lemma only.

Annual or perennial grasses of varying habit, with narrow leaf-blades.

A genus with numerous species throughout the warm regions of the world.

Key to the species of *Eragrostis*.

Paleas ciliolate on the keels:—

Margins of lemmas ciliate. 1. *E. coarctata*.

Margins of lemmas eciliate:—

Panicles effuse:—

Plants viscous. 2. *E. viscosa*.

Plants not viscous. 3. *E. tenella*.

Panicle spiciform, contracted. 4. *E. riparia*.

Paleas scaberulous or smooth on the keels:—

Lemmas less than 1 mm. long, spikelets

2-3 mm. long, 1-1·25 mm. wide:—

Spikelets densely clustered, 6-14-flowered, branches more or less solitary. 5. *E. diarrhena*

- Spikelets loose, scattered, few-flowered, branches of panicle usually whorled. .. 6. *E. japonica*.
- Lemmas over 1 mm. long :—
- Leaf-blades glandular on the margins; keels of lemmas usually glandular :—
 - Spikelets oblong or ovate-oblong, 2·75-3·5 mm. wide. .. 7. *E. cilianensis*.
 - Spikelets narrow-oblong, 1·5-2 mm. wide. .. 8. *E. poaeoides*. - Leaf-blades and lemmas eglandular :—
 - Spikelets broadly ovate or broadly oblong, 3 mm. wide. .. 9. *E. unioloides*.
 - Spikelets lanceolate to narrowly oblong, 1·75-2·5 mm. wide :—
 - Lemmas closely imbricate with flat margins, ovate to broadly ovate in side view, annual. .. 10. *E. tremula*.
 - Lemmas loosely imbricate or contiguous with usually incurved margins, lanceolate to oblong or narrowly ovate in side view :—
 - Spikelets 2-2·5 mm. wide, oblong. 11. *E. gangetica*.
 - Spikelets 1-1·5 mm. wide, linear to lanceolate or oblong :—

Pereennials :—

 - Spikelets blackish or bluish-grey; panicles lax; pedicels long. .. 12. *E. nigra*.
 - Spikelets silvery, crowded, almost secund; pedicels short. .. 13. *E. zeylanica*.

Annuals :—

 - Spikelets circa 1 mm. wide; lower branches whorled. .. 14. *E. pilosa*.
 - Spikelets circa 1·5 mm. wide; lowest branches solitary. .. 15. *E. nutans*.

1. Eragrostis coaretata Stapf ex Hook. f. in F.B.I. VII. (1897) 313.

A perennial grass with thick fibrous roots. *Culms* tufted, geniculately ascending from a nodose, branched stock; base clothed with short hard sheaths. *Leaves* linear, terminating in a sharp point, usually flat, sometimes convolute, up to 9 cm. long by 6 mm. broad, smooth and glabrous, somewhat glaucous; sheaths tight, close fitting, smooth and glabrous or sparingly hairy, striate, collar bearded with long hairs; ligules a ring of short hairs.

Inflorescence a much contracted elongate, subspiciform panicle, often lobed, occasionally lax; rhachis stout, scaberulous, angled; branches very short, hispid in the axils. *Spikelets* crowded on short pedicels, 2-3 mm. long by 1.5 mm. broad. *Glumes* almost equal, 1.25-1.5 mm. long. *Lemmas* 1.5-2 mm. long, 3-nerved, membranous, ciliate on the margins especially towards the base, lateral nerves green, prominent; palea 2-keeled, as long as the lemma, very strongly ciliate on the keels. *Stamens* 3, .5 mm. long. *Caryopsis* ovoid-ellipsoid, .5 mm. long, light to dark brown.

This grass has only been found on Tura Top, GARO HILLS, 3,400 ft.

2. *Eragrostis viscosa* Trin. in Mem. Acad. Petersb. ser. 6. 1 (1831) 397. Syn. *E. tenella* Roem. et Schult. var. *viscosa* Stapf in Hook. f. F.B.I. VII (1892) 315.

A tufted, sweet-scented grass, 12-30 cm. high, the panicles occupying the greater part of the plant. *Stem* and rhachis of panicle, pedicels and glumes with scattered microscopic glands. *Leaves* flat or convolute, erect, patent, 2.5-3.5 cm. long, with rigid tips; sheaths loose, striate, often glandular; ligule-base and mouth of sheath with very long cilia.

Panicles dense, cylindrical or oblong, 7-18 cm. long and up to 3.5 cm. broad, often occupying more than half the plant; branches very numerous, more or less spreading, equal, sometimes opposite or 2-nate, but never in interrupted whorls, rhachis usually glabrous rarely obscurely bearded at the nodes. *Spikes* 5-to 20-flowered, often purplish, usually about 3 mm. long; rhachilla readily breaking up. *Glunes* almost equal or the lower very slightly shorter than the upper, .75-1.25 mm. long, obtuse. *Lemmas* broadly elliptic in shape, obtuse or rounded, with the keel minutely scaberulous, 1-1.25 mm. long. *Palea* nearly as long as the glume, rigidly ciliate on the keels. *Grain* pale-brown, polished, about .5 mm. long.

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3. Eragrostis tenella Roem. et Schult. Syst. II (1817) 576.

A loosely tufted annual. *Culms* erect or geniculately ascending, 12-50 cm. high, very slender, wiry, 3-5-noded, unbranched or frequently branched, glabrous and smooth. *Leaf-blades* narrowly linear, tapering to a fine point, 2-12 cm. long, 1-3 mm. wide, flat or rolled when dry, soft, spreading, glabrous and smooth. *Leaf-sheaths* shorter than the internodes, bearded at the mouth with soft spreading hairs, the remainder usually glabrous and smooth; ligule reduced to a fringe of short hairs.

Panicle loose and open, or contracted and rather dense, ovate to oblong in outline, 5-13 cm. long, 1.5-3.5 cm. wide, straw-coloured, green or purplish; rhachis usually with spreading hairs at the nodes; branches very fine, glabrous; pedicels 1-5 mm. long. *Spikelets* oblong to broadly oblong, 1-4 mm. long, 3-9-flowered; rhachilla articulated, breaking up from above downwards. *Glumes* ovate-oblong to oblong, obtuse or slightly acute, 1-nerved; lower .5-1 mm. long, upper .7-1.3 mm. long. *Lemmas* oblong, very obtuse, almost truncate when flattened, .8-1.2 mm. long, thinly membranous; paleas as long as the lemmas, ciliate on the keels with spreading rigid hairs. *Anthers* very minute.

Very common in the plains in sandy places.

4. Eragrostis riparia Nees in Wight Cat. n. 1787.
Syn. *E. tenella* Roem. et Schult. var. *riparia* Stapf in Hook f. F.B.I. VII (1897) 315.

Perennial. *Culms* wiry, 12.5-50 cm. tall, terete, smooth and glabrous, often densely tufted. *Leaf-blades* linear-lanceolate, 1-6 cm. long, up to 4 mm. broad, tapering to a point, flat but rolled in the dried condition, smooth and glabrous except at the base where a few long hairs may be seen; sheaths shorter than the internodes, smooth and glabrous, tight or loose; with a few long hairs at the auricles and on the collar; ligules a membranous ring, erose or truncate, ciliate.

Inflorescence a very narrow, contracted, spiciform panicle, 1.25-6 cm. long, branches sub-filiform or capillary.

rhachis glabrous. *Spikelets* 1-3 mm. long, long or short pedicelled, 3-9-flowered; lower glume 1 mm. long; upper 1.3 mm. long. *Lemmas* 1-1.5 mm. long, lateral nerve near the middle of the sides; *paleas* 1-1.25 mm. long, keeled, keels ciliate with stiff cilia which are shorter than the width of the expanded *palea*. *Anthers* .4 mm.; *caryopsis* ovoid, .4 mm.

Common in the plains. Said to be a good fodder grass.

5. Eragrostis diarrhena Steud. Syn. Pl. Glum. (1854) 226. Syn. *E. interrupta* Beauv. Agrost. (1812) 71 var. *diarrhena* Stapf in Hook. f. F.B.I. VII (1897) 316.

An annual or perennial grass. *Culms* up to 80 cm. tall, terete, smooth, glabrous and polished. *Leaves* linear, narrowed at the base, acuminate, slightly rough on the upper surface and on the margins; flat, up to 15 cm. long, sheaths rather loose, slipping from the culms, smooth and glabrous, striate, scarious on the margins; ligule membranous, short.

Panicle contracted, long and narrow, made up of numerous fascicled spiculate branches giving the panicle a lobed appearance; rhachis stout, smooth and glabrous; branches numerous, filiform, closely spiculate almost to the base, usually erect, rarely spreading. *Spikelets* equal to or longer than their pedicels, up to 3 mm. long by 1 mm. wide or less, often reddish or pinkish in colour, linear, occasionally ovate in shape. *Glumes* sub-equal .75 mm. long, acute, 1-nerved; *lemmas* very obtuse, almost truncate, 1 mm. long with green nerves; *palea* shorter than the *lemmas*; *keels* scaberulous. *Stamens* 2. *Caryopsis* obovoid.

Common in the plains in moist sand. A good fodder grass and liked by stock.

6. Eragrostis japonica Trin. in Mem. Acad. Petersb. ser. 6. I (1831) 405. Syn. *E. interrupta* var. *tenuissima* Stapf in Hook. f. F.B.I. VII (1897) 316.

A tufted annual. *Culms* erect or geniculate at the base, slender to stout, 15-70 cm. high, simple or branched, 1- to 4-noded, glabrous and smooth. *Leaves* glabrous and smooth;

blades linear-acute, 2-20 cm. long, 1.5-4 mm. wide, flat or convolute; ligule reduced to a ciliolate rim.

Panicle linear, lanceolate to ovate-oblong in outline, open and loose or contracted, 6-25 cm. long; rachis glabrous, smooth below and scaberulous towards the apex, branches spreading, in whorls or clusters, or solitary, divided from or near the base; branches very slender but rigid, scaberulous 5-8 cm. long; pedicels up to 2 mm. long. *Spikelets* linear compressed, 2.3-5 mm. long, 1 mm. wide, 6-10-flowered; rhachilla disarticulating between the florets. *Glumes* acute or obtuse, hyaline, 1-nerved; lower lanceolate to ovate, 6-8 mm. long; upper ovate to oblong, 3-1 mm. long. *Lemmas* lanceolate to lanceolate-oblong in profile, 7.1.5 mm. long, thinly membranous. *Paleas* 2-keeled nearly as long as the lemmas, keels scaberulous or smooth, falling with the lemma and rhachilla-joint at maturity. *Anthers* 2-2 mm. long. *Grain* ovoid to ellipsoid, 3.5 mm. long.

From the plains up to 7,000 ft.

7. *Eragrostis ciliaris* (*All.*) Link ex Lutati, in Malpighia XVIII (1904) 336. Syn. *E. major* Host. Gram. Austr. IV (1809) 14.

An annual grass. *Culms* up to 90 cm. tall but usually much shorter, erect or geniculate at the base, glabrous, smooth, branched, leafy. *Leaf-blades* rather soft, smooth and glabrous, up to 18 cm. long by 9 mm. wide, tapering from the base to a fine point, glandular on the margins; leaf-sheaths smooth and glabrous, rather loose at the base; ligule a ciliolate rim.

Panicle open or contracted up to 20 cm. long, rather rigid, ovate-oblong in shape, rachis rigid, smooth; branching to the second or third degree, spreading or suberect, capillary; pedicels shorter than the spikelets. *Spikelets* crowded, up to 60-flowered, usually much less, 4-6-flowered, and then only 6 mm. long, yellowish or olive-grey in colour; rhachilla tough, zigzag, with smooth internodes. *Glumes* ovate-acute with scabrid keels; the lower smaller than the upper 1-(sometimes 3-) nerved, the upper 3-nerved; lemmas broadly ovate, acute, sometimes apiculate, 2 mm. long,

strongly nerved; palea obovate, much curved, shorter than its lemma, with ciliolate keels. *Stamens* 3, anthers .4 mm. long. *Grain* globose, .6 mm. in diameter, microscopically rugulose, reddish brown.

A good fodder for cattle. Not common.

8. Eragrostis poaeoides Beauv. Agrost. (1812) 162.
Syn. *E. minor* Host. Flor. Austr. I (1827) 135.

An annual grass with densely tufted, slender, erect culms 15-40 cm. tall, smooth and glabrous. *Leaf-blades* rounded at the base, linear, tapering to a fine point, smooth and glabrous or with a few hairs near the throat on the upper surface, up to 20 cm. long by 5 mm. wide; margins definitely glandular; leaf-sheaths shorter than the culms, smooth and glabrous, striate, somewhat keeled; ligule a densely pubescent rim.

Panicle oblong or ovate, sometimes contracted, rhachis smooth and glabrous, terete grooved; branches angled, scabrid on the angles, sparingly branched; nodes of the rhachis glabrous. *Spikelets* linear-oblong, olive-grey or even purplish-grey in colour, longer than the pedicels, up to 7 mm. long, 1.5 mm. wide, up to 12-flowered; rhachilla tough. *Glumes* sub-equal or the upper a little longer, 1.1-2 mm. long, 1-nerved, acute; lemmas overlapping, ovate-acute, minutely scabrid between the nerves in the upper third, strongly nerved; palea obovate, 1 mm. long, keels minutely scabrid. *Anthers* minute. *Grain* up to .75 mm. long, rounded, dorsally slightly flattened.

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9. Eragrostis unioloides Nees ex Steud. Syn. Pl. Glum. (1854) 264. Syn. *E. amabilis* Wight et Arn. ex Nees in Hook. et Arn., Bot. Beech. Voy. 251 (non Linn.).

An annual grass. *Culms* loosely tufted or solitary, erect or geniculately ascending, 14-45 cm. high, very slender, unbranched, 2-3-noded, glabrous and smooth. *Leaves* mostly basal; blade tapering from an abruptly contracted base to a fine point, 3 to 10 cm. long, 2-5 mm. wide, flat, thin, glab-

rous or with a few scattered hairs above, smooth except for the rough margins; sheaths longer or slightly shorter than the internodes, glabrous except for a few hairs at the mouth. smooth; ligule reduced to a very narrow rim.

Panicle lanceolate, ovate or oblong in outline, 5-14 cm. long, 3-3·5 cm. wide, green or reddish purple, becoming straw-coloured. Spikelets strongly compressed, 20-50-flowered, rhachilla straight, persistent. Glumes lanceolate to ovate, finely acute, sub-equal, up to 2 mm. long, 1-nerved, membranous. Lemmas closely imbricate, ovate or ovate-elliptic in profile, obtuse or slightly acute, 2 mm. long, finely membranous, minutely granular, side-nerves straight and prominent; paleas almost as long as the lemmas and falling with them at maturity, keels narrowly winged, minutely ciliolate. Anthers minute. Grain oblong or elliptic-oblong, compressed ·6-·8 mm. long.

Very common in the plains and up to 2,000 ft. Easily recognised by the reddish panicle and compressed spikelets.

10. *Eragrostis tremula* Hochst. ex Steud. Syn. Pl. Glum. (1854) 269.

Annual. Culms 15-80 cm. high, densely tufted, erect or geniculately ascending. Leaf-blades linear-lanceolate, tapering to a fine point, glabrous or sparsely hairy, 2·5-20 cm. long, rounded at the base, margins eglandular and very finely serrate; sheaths smooth, glabrous, changing to a mauve colour when dry; ligule a rim of short stiff hairs.

The inflorescence is a very large, lax, effuse and nodding panicle, pyramidal or oblong-ovate in shape, up to 50 cm. long by 30 cm. broad, rhachis stout, angled, scaberulous; branches solitary, slender, ascending, scaberulous; branchlets capillary, with long white-hairs in all axils of the panicle; pedicels capillary, very slender, shorter or longer than the spikelets; spikelets up to 60-flowered, linear in shape, compressed, glabrous, green or tinged with violet, up to 2·5 cm. long. The glumes are sub-equal, 1·5-1·2 mm. long, ovate-acute, membranous, 1-nerved, keeled; keel scaberulous. Lemmas broadly ovate-obtuse in shape when flattened. 1·5-2 mm. long; palea obovate-oblong, keels scabrid, persistent.

Stamens 3. *Lodicules* 2. *Caryopsis* nearly globose, compressed or one side obscurely rugulose.

A good fodder grass; fairly common in the plains and in rice fields in MANIPUR.

11. *Eragrostis gangetica* Steud. Syn. Pl. Glum. (1854) 266. Syn. *E. elegantula* Stapf in Hook f. F. B. I. VII (1897) 318.

A perennial grass. *Stems* tufted 30 cm. to 1 m. high, stout, smooth, shining, simple or branched, sub-erect. *Leaves* few, 5-20 cm. long, very narrow, convolute, rigid, quite smooth, glaucous, linear, tapering to a fine point; sheaths glabrous, except the mouth which is sometimes bearded; ligule a minutely ciliolate rim.

Panicle oblong, 5-15 cm. long, nodding; branches solitary, rather distant, often long, suberect or the lower spreading; rhachis glabrous; pedicels of spikelets short. *Spikelets* 4-6 mm. long, linear to linear-oblong, 10-30-flowered; rhachilla tough, glabrous, persistent, the internodes short. *Lower glume* 1.6 mm. long, ovate-oblong, acute, 1-nerved; upper slightly longer, 1-nerved. *Lemmas* broadly ovate, sub-acute, reaching to nearly 2.5 mm. long; palea deciduous, slightly shorter than its lemma, keels scaberulous. *Stamens* 3; anthers about 1 mm. long, yellow. *Grain* oblong, about .8 mm. long, brown.

Valuable fodder. Very common in the plains and hills. In ASSAM this plant is exceedingly glaucous, often appearing bluish at a distance.

12. *Eragrostis nigra* Nees ex Steud. Nom. ed. 2. I (1840) 563.

A very variable perennial. *Culms* 15 cm.-1 m. high in the more robust plants, erect, stout, (in less robust forms slender and sub-erect), simple or branched, leafy at the base. *Leaves* in small forms basal and flat 15 mm. long, 2.5-3 mm. broad, in more robust plants elongate, lanceolate, tapering to a sharp point; margins smooth or scarcely scabrid, surfaces smooth, a few hairs on the margins at the base; sheaths narrowly terete or obscurely compressed,

mouth bearded, margins smooth or ciliate; ligule a ciliate rim.

Inflorescence a large, spreading panicle, ovate or oblong-lax many- or few-flowered, up to 60 cm. long, much branched; branches usually in whorls or fascicles rarely solitary or geminate; rhachis glabrous at the nodes. Spikelets linear to oblong, 4-4.5 mm. long, olive grey, seated on pedicels which are usually longer than the spikelets. Glumes sub-equal, acuminate, strongly 1-nerved, keeled, membranous, 1.5-1.75 mm. long; lemmas ovate-acute, 1.5-1.8 mm. long, palea obtuse, denticulate, persistent; stamens 3, anthers .5 mm. long, *Caryopsis* short, truncate at both ends, .7 mm. long, dorsally slightly grooved.

Exceedingly common in the hills. 2-4,000 ft.

13. *Eragrostis zeylanica* Nees et Mey. in Nov. Act. 204. Syn. *E. elongata* of F. B. I. VII (1897) 319, not of Jacq.

A robust perennial with numerous roots, tufted. Culms up to 30 cm. tall, sub-erect or prostrate, often sub-erect from a geniculate base; upper internodes very long. Leaves for the most part basal, narrow, erect, flat or rolled, often rigid, hirsute towards the base and on the upper surface; sheaths tight, smooth, bearded at the throat, auricles glabrous or without auricles; ligules merely a ring of short hairs.

Inflorescence an oblong or oval panicle, very variable, erect, very lax 5-12 cm. long, sometimes contracted; principal axis slender, straight, glabrous, smooth or slightly scabrid on the angles; branches solitary, often simple, rarely branched, distant, horizontal, filiform, scaberulous, often hairy in the axils. Spikelets very shortly pedicelled, rather crowded, 5-9 mm. long, linear-acute, sides almost parallel, 25-30-flowered, greyish or dark-brown; rhachilla somewhat robust, rigid, persistent, smooth; glumes unequal, strongly 1-nerved, the lower 1.1-1.5 mm. long, the upper rather shorter, lanceolate; lemmas 1.2 mm. long, firm, coriaceous, with hyaline margins, not punctate, broadly ovate-acuminate, laterally much compressed, keel almost straight, the lateral nerves being rather prominent; paleas

1·2-1·3 mm. long, persistent, linear-oblong, obtuse, keels well-marked, scabrid. *Stamens* 3, anthers very small. *Caryopsis* ovoid, globular, sub-globular or shortly sub-elliptic, ·5 mm. long, somewhat rugose.

So far this grass has only been obtained in the SURMA VALLEY. Common at Lowacherra, SYLHET.

14. *Eragrostis pilosa* Beauv. Agrost. (1812) 71.

An annual grass. *Culms* up to 30 cm. tall, geniculate at the base or more often erect, very slender, soft, densely tufted. *Leaves* narrowly linear, acuminate, often convolute, generally flat, rough on the margins and on the upper surface, glabrous; sheaths tight, smooth and glabrous except at the throat where the small auricles are hairy; ligules a ring of short hairs.

Inflorescence an erect, sometimes nodding, panicle, spreading at anthesis, broadly elliptic in outline, 5-10 cm. long, solitary or purplish in colour; rhachis filiform; nodes sometimes hairy; branches capillary, flexuous, scaberulous or almost smooth, bare at the base; pedicels almost as long as the spikelets. *Spikelets* 2·5-3 mm. long, rarely longer, erect, ovate or narrowly elliptic in outline, 4-10-flowered; rhachilla robust, flexuous, smooth; glumes very unequal, hyaline, lanceolate-acute; lower ·3-·5 mm. long, ovate, nerveless; upper ·9-1 mm. long, ovate-lanceolate, acute, strongly 1-nerved, keel smooth; lemmas 1·2-1·3 mm. long, ovate-subacute, 3-nerved, the lateral nerves hardly prominent; palea almost persistent, sub-denticulate at the apex, keel smooth or nearly so. *Stamens* 3. *Caryopsis* narrowly obovoid or ellipsoid.

Not common; plains to 4,000 ft. Said to be an excellent fodder grass.

15. *Eragrostis nutans* Nees ex Steud. Nom. ed. 2. I (1840) 563. Syn. *E. stenophylla* Hochst. ex Miq. Anal. Bot. Ind. II (1851) 271 (in part).

Perennial. *Stems* densely tufted, 30-45 cm. high, erect or geniculately ascending, simple or branched; upper internodes long. *Leaf-blades* 7·5-12 cm. long, very narrow,

strict, rather stiff, usually convolute, smooth, sometimes quite flat, glabrous, not glaucous; sheaths smooth; ligule a narrow membranous ring.

Panicle ovate or oblong or sub-linear, sub-erect or nodding; branches rather distant, alternate, oblique, spreading when ripe, much divided upwards; rachis slender, smooth; pedicels of spikelets filiform. Spikelets 4-6 mm. long, linear-oblong, 20-30-flowered, rachilla zigzag. Lower glume 3 mm. long, upper 1 mm. long, lemmas ovate-oblong sub-acute, about 1·6 mm. long, with smooth keel; palea linear-oblong, caducous with the glumes, keels scabrid. Stamens 3, anthers minute. Grain globose or globosely ellipsoid, 2·5 mm. long, reddish-brown, smooth.

Common in the plains.

3. DESMOSTACHYA Stapf.

Spikelets linear, strongly laterally compressed, closely imbricate, alternate, sessile or sub-sessile on, and falling entire from, the slender rachis of secund more or less distinctly 2-ranked spikes which are crowded into long narrow spike-like panicles; rachilla tough. Florets numerous, hermaphrodite, rather loose. Glumes very unequal, membranous, 1-nerved, keeled. Lemmas ovate, acute or sub-acute, entire muticous, rigidly membranous, 3-nerved, acutely keeled, glabrous; side nerves evanescent upwards. Paleas slightly shorter than the lemmas, 2-keeled. Lodicules 2, rather large, hyaline, nerved at the base. Stamens 3. Ovary glabrous; styles distinct, slender; stigmas plumose, laterally exserted. Caryopsis loosely enclosed by the scarcely altered lemma and palea, obliquely ovoid, obtusely triquetrous; pericarp thin, adnate to the seed; embryo about 1/3 the length of the caryopsis; hilum small, basal, punctiform.

Rather coarse grasses.

Desmostachya bipinnata Stapf in Flor. Cap. VII. 632. Syn. Eragrostis cynosuroides Beauv. Agrost. (1812) 71, 162.

Perennial. Culms tall, ascending from a stout creeping

rootstock, 3-1 m. high, branching from the base, tufted, stout, smooth and glabrous, leafy; stolens very stout, covered with shining sheaths. *Leaf-blades* linear to linear-lanceolate, acuminate, tapering to a filiform tip, 15-40 cm. long, by 4-10 mm. wide, rigid, flat, margins scarcely thickened, hispid towards the base; sheaths leathery, glabrous, hairy at the mouth; ligule a ciliolate ridge.

Panicle very coarse, 15-45 cm. long by 1.3-3.8 cm. broad, narrowly pyramidal or columnar, often interrupted, common axis puberulous; branches many, short, about 2 cm. long, crowded from the base with sessile imbricating spikelets; branchlets rigid, spreading, glabrous or hispidulous. *Spikelets* sessile, secund, 2-seriate and crowded, deflexed, pale-brown, rather shining, 13 mm. long, up to 30-flowered; rhachilla tough, internodes very short. *Glumes* very unequal; lower 5 mm. long; upper 1.6-2 mm. long, ovate, acute, coriaceous; palea shorter than its lemma, sub-coriaceous with minutely scabrid keels. *Stamens* 3; anthers 8 mm. long. *Caryopsis* 5-6 mm. long, obliquely ovoid, laterally compressed, obscurely trigonous.

One sheet labelled "ASSAM" without locality, in the Kew Herbarium. Said to be an excellent desert fodder grass.

4. ERAGROSTIELLA Bor.

ERAGROSTIELLA Bor, genus novum graminacearum *Eragrosti* Beauv. affinis, a qua culmis gracilibus dense caespitosis et spiculis in racemis longis, terminalibus, simplicibus dispositis, distinguitur.

ERAGROSTIELLA Bor.

Spiculae lineares vel ovato-oblongae, leviter vel valde lateraliter compressae, sub-secundae, sub-sessiles vel breviter pedicellatae, in racemis longis, terminalibus, simplicibus, gracilibus, laxae vel imbricatae dispositae; rhachilla continua vel inter anthoecia tarde disarticulans, internodiis glabris, angulatis, superne leviter incrassatis. *Anthoecia* 6-20, hermaphrodita vel sumnum sterile et plus minusve redactum. *Glumae* aequales, vel superior longior, carinatae; inferior 1-nervia, superior 3-nervia; lemmata imbricata, ovata vel lanceolata, apice mutica, dorso leviter vel valde carinata vel rotundata, acuta vel obtusa, membranacea

vel chartacea, glabra; paleae lemmatibus subaequilongae. vel paulo breviores, bicarinatae; carinae plus minusve alatae. *Stamina* 3. *Ovarium* glabrum. *Lodiculae* 2. cuneatae, carnulosae. *Styli* distincti, terminales; stigmata plumosa, ex anthoeciis lateraliter exserta.

Gramina perennia, dense caespitosa; vaginæ basales-persistentes; foliorum laminae angustæ. filiformes, rarae latae, coriaceæ.

ERAGROSTIELLA Bor.

Spikelets linear to ovate-oblong, strongly or slightly compressed, shortly pedicelled or sub-sessile, in two rows, distant or crowded, in long, slender, terminal racemes: rhachilla tough, persistent, or tardily breaking up, glabrous, angled, slightly swollen at the top of the joint. *Florets* 6-20, hermaphrodite, or the uppermost more or less reduced. *Glumes* sub-equal, or the upper the longer, keeled, deciduous, the lower 1-nerved, the upper 3-nerved, glabrous; lemmas imbricate, ovate or lanceolate, slightly or strongly keeled on the back, acute or obtuse, membranous or chartaceous, glabrous; palea as long as the lemma, keeled, winged on the keels or not, often persistent on the rhachilla. *Lodicules* 2. small, cuneate, fleshy. *Stamens* 3. *Ovary* glabrous; style distant, terminal; stigmas plumose laterally exserted.

Perennial grasses, densely caespitose; leaves mostly convolute, filiform, rarely flat; ligule short; base of the culm covered with the remains of old sheaths.

Eragrostiella leioptera (*Stapf*) *Bor* com. nov. Syn. *Eragrostis leioptera* *Stapf* in *Hook f. F. B. I.* VII (1897) 325.

Perennial. *Culms* densely tufted, bases covered with the remains of old sheaths, 30-60 cm. tall, erect, slender, strict, smooth and glabrous. *Leaf-blades* 20-30 cm. long, glabrous, stout, terete, pungent; sheaths short, slightly compressed and sub-keeled on the back, smooth and glabrous, shorter than the internodes, a few hairs at the mouth; ligule very narrow, hardly more than a rim with a few hairs.

Inflorescence a long slender, erect raceme 15-25 cm. long with the spikelets secund, erect, not crowded, dis-

tichously spreading, rhachis angular and smooth. Spikelets 8 mm.-1·25 cm. long, sub-sessile, oblong, compressed, 10-20-flowered. The spikelets are secund, a point which is not always apparent from herbarium specimens. Glumes sub-equal, tumid, about 1·75 mm. long or the lower shorter, lower distinctly keeled the upper dorsally rounded; lemmas broadly ovate, obtuse or subacute, 2·5 mm. long; palea as long as the lemmas, two-keeled, keels winged ciliolate, hyaline. Anthers about 1·5 mm. long.

In certain depauperate forms of this grass it is found that the spikelets may consist of nothing but empty lemmas without even a palea. In well-developed plants it is common to find a few empty lemmas above the glumes.

Very common in the KHASI and JAITIA HILLS, 5-6,000 ft.

The genus *Eragrostiella* comprises a number of grasses which have been hitherto included in *Eragrostis* but which differ very markedly in inflorescence and habit from the very great majority of the species in that genus. The main characteristics of the species placed in *Eragrostiella* are the spicate inflorescence and the tufted habit. Bentham in Jour. Linn. Soc. XIX (1882) 116 placed all these forms and the very different *Eragrostis cynosuroides* Beauv. in one section of *Eragrostæ* which he called *Plagiostachya*. Hook. f. in F.B.I. VII (1897) 324 separates *E. cynosuroides* Beauv. from the rest and placed it in a special section *Desmostachya* and retained the section *Plagiostachya* for those grasses with a spicate inflorescence. Stapf subsequently raised *Desmostachya* to generic rank and *Eragrostis cynosuroides* became *Desmostachya bipinnata* (Linn.) Stapf. There is no reason why *Plagiostachya* (of Hook. f.) should be maintained any longer as a section of the genus *Eragrostis* and I propose to raise it to generic rank under the name *Eragrostiella* Bor.

The following new combinations of Indian grasses are necessary. *Eragrostiella leiopetra* (Stapf) Bor, comb. nov.; *E. bifaria* (Wight) Bor, comb. nov.; *E. brachyphylla* (Stapf) Bor, comb. nov.; *E. walkeri* (Stapf) Bor, comb. nov.; *E. collettii* (Stapf) Bor, comb. nov.; *E. naroides* (Trin.) Bor, comb. nov.; *E. secunda* (Nees) Bor, comb. nov.

5. ELEUSINE Gærtn.

Spikelets laterally compressed, sessile, densely overlapping, in two rows on one side of the flattened rhachis; the rhachis terminating in a spikelet; rhachilla disarticulating above the glumes and between the lemmas or tough. Florets 3-12, hermaphrodite or the uppermost reduced, exserted

from the glumes. *Glumes* persistent, slightly unequal, keeled, obtuse or acute, membranous, lower 1-nerved, upper 1- to 5-nerved, with the nerves close to the keel.

Lemmas very similar to the glumes, 3-nerved or with an additional 2 nerves near the keel, the lateral nerves sometimes only prominent near the base. *Paleas* shorter than the lemmas, 2-keeled with the keels narrowly winged. *Lodicules* 2. *Stamens* 3. *Ovary* glabrous. *Grain* oblong to globose, free between the lemma and palea, with a loose delicate pericarp.

Annual or perennial grasses with flat or folded leaf-blades and spikes in a terminal umbel, sometimes one or more below, or in whorls towards the apex of the culms, rarely solitary.

Key to the species of *Eleusine*.

Spikes digitate.

- Spikes slender, nearly glabrous at the base; seeds oblong, obtusely trigonous. . . . 1. *E. indica*.
- Spikes stout, often incurved, pubescent at the base; seed globose. . . . 2. *E. coracana*.
- Spikes whorled. . . . 3. *E. verticillata*.

1. *Eleusine indica* Gaertn. Fruct. I (1788) 3.

Annual. *Culms* loosely to densely tufted or solitary, erect or slightly geniculate, 10-75 cm. high, slender to stout, compressed, simple or branched, 2- to 3-noded, glabrous and smooth. *Leaves* usually crowded at the base; blades linear-acute 10-35 cm. long, 2-5 mm. wide, flat or folded, erect, thin to rigid, glabrous and smooth, rarely sparingly hairy; ligule very small or absent.

Inflorescence of digitate spikes, straight, slender to stout, 2-15 cm. long, usually with spikelets right to the base, 2-4 in a terminal umbel, occasionally with one or more below it, rarely solitary; rhachis pubescent to villous at the base. *Spikelets* glabrous, ovate or oblong, green, 3-7 mm. long, 3-8-flowered. *Glumes* lanceolate, acute or slightly obtuse; lower 2-3 mm. long; upper 3-4 mm. long; lemmas lanceolate, acute, 3-4 mm. long; paleas about two-thirds the

length of the lemmas. *Grain* oblong. 1·5-2 mm. long. transversely rugose.

Very common in plains and hills up to 5,000 ft. A good fodder for all stock; suitable for pasture.

2. *Eleusine coracana* Gaertn. Fruct. I (1783) 8 t. i.

Stouter than *E. indica*, up to 1 m. high, with leaves often far overtopping the stem, 30-60 cm. long, 5-6 mm. broad, with compressed, loose sheaths and ligules of hairs. *Spikes* 4-7, sub-erect, with ends or even the whole spike frequently incurved, rhachis of spikes often pubescent at the base, somewhat trigonous, or flattened on the back. *Spikelets* much congested, awnless, 3- to 5-flowered. *Lemmas* broader and more ovate than in *E. indica* and often with 1 to 2 nerves in the margins, variable in size and up to 5 mm. long. *Grain* globose, dark brown, smooth in some varieties, at other times somewhat rugose, with a depressed black hilum and slightly flattened on one side.

Often cultivated in the hills, 2-5,000 ft.

3. *Eleusine verticillata* Roxb. Flor. Ind. I (1832) 346.

Annual. *Culms* tufted, erect, 30-90 cm. high, slender to stout, simple or branched, smooth and glabrous. *Leaf-blades* linear, lanceolate, tapering to a fine point, up to 20 cm. and more long, up to 7 mm. wide, flat or folded, erect, thin, glabrous and smooth; sheaths compressed and keeled, glabrous and smooth; ligule thin, truncate, ciliolate, about 1 mm. long.

Spikes 6-20, scattered or in whorls towards and at the apex of the culms, 2-9 cm. long with spikelets right to the base, pale-green, at length straw-coloured; rhaelis hairy at the base. *Spikelets* ovate or oblong, 4-7 mm. long, 6-12-flowered, pale-green. *Glumes* lanceolate; lower finely acute, about 3 mm. long, upper mucronate or slightly awned, about 4 mm. long. *Lemmas* spreading, ovate in profile, finely acute or acuminate, 3-4 mm. long, minutely 2-toothed with a mucro or short awn from the sinus, 3-nerved with the lateral nerves

prominent; paleas about 2/3rds the length of the lemmas. *Grain* oblong rugose, about 1 mm. long.

Said to have been found in the SURMA VALLEY.

6. DACTYLOCTENIUM Willd.

Spikelets laterally compressed, densely imbricate, usually spreading at right angles, sessile in 2 or more ranks on one side of the narrow flattened rhachis of digitate spikes; the rhachis projecting in a point beyond the spikelets, rhachilla slowly disarticulating above the glumes and not between the lemmas. *Florets* 3-5, hermaphrodite or the uppermost reduced. *Glumes* slightly unequal, keeled, 1-nerved; lower ovate to oblong, acute or obtuse, persistent; upper oblong-obtuse, mucronate or short awned. *Paleas* almost as long as the lemmas, 2-keeled. *Lodicules* 2, *Stamens* 3. *Ovary* glabrous. *Grain* oblong to globose, transversely rugose to nearly smooth, enclosed in a thin pericarp which disappears early.

Annual or perennial grasses with flat leaf-blades and spikes in a terminal umbel, rarely solitary.

Chromosome number 48.

***Dactyloctenium aegyptium* Beauv. Ess. Agrost. (1812) 72.**

Annual. *Culms* erect or usually ascending from a prostrate base, and rooting at the nodes, 22-30 cm. high, slender to moderately stout, 2- to 3-noded, glabrous and smooth. *Leaf-blades* linear, acute, 2.5-20 cm. long, 2.5 mm. wide, flat, loosely or densely ciliate on the margins and sometimes sparsely hairy on the surface with tubercle-based hairs or glabrous; sheaths shorter than the internodes, glabrous or scantily hairy, lower surface whitish and keeled; ligule very short, ciliolate.

Spikes 2-6, rarely solitary, 1.5 cm. long, light or dark olive-grey, with spikelets right to the base, rhachis keeled, pubescent at the base, bare at the tip for 2-3 mm. Spikelets 3-4 mm. long. Lower glume 1.5-2.5 mm. long; upper glume 2 mm. long, mucronate or awned with an awn up to 2 mm. long. Lemmas 2.5-3 mm. long, mucronate or very short

awned; palea 2-keeled, keels narrowly or broadly winged, ciliate. *Anthers* 1.5 mm. long. *Grain* obovoid-globose, 1.1-1.5 mm. long, very rugose.

Common in the plains and hills. An excellent fodder, said to be strengthening for horses. The grain is edible.

7. LEPTOCHLOA Beauv.

Spikelets very minute, laterally compressed, alternate and unilaterally 2-seriate on the very slender, spiciform branches of a lax panicle, sessile or minutely pedicelled, not jointed at the base, rhachilla jointed at the base and between each lemma, produced between each lemma and often beyond the terminal. *Lower and upper glumes* sub-equal or unequal, oblong, lanceolate or almost linear-lanceolate, 1-nerved. *Lemmas* ovate (when flattened), 3-nerved, 1-nerved in the keel and usually 1 near each margin; palea shorter, 2-nerved. *Lodicules* cuneate. *Anthers* 3, short. *Styles* free. *Grain* oblong-obvoid, sub-globose or trigonous, invested by the glume and palea.

Annual, usually slender herbs. *Leaves* flat or involute.

Key to the species of *Leptochloa*.

- | | |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Spikes up to 10 cm. long; spikelets 2-3-flowered,
less than 2.5 mm. long; upper glume longer
than first floret. | 1. <i>L. filiformis</i> . |
| Spikes up to 10 cm. long; spikelets 4-6-
flowered, 2.5 mm. or more long; upper glume
shorter than first floret. | 2. <i>L. chinensis</i> . |

1. *Leptochloa filiformis* Roem. & Schult. Syst. ii, 580.

An annual grass. *Stems* slender, up to 60 cm. tall, erect from a more or less geniculate base. *Leaf-blades* glabrous or sparsely hairy, 10-25 cm. long, up to 1 cm. broad, flat, flaccid, tapering to a point; sheaths smooth, glabrous or sparsely hairy; ligule very short, .5 mm. long or less, lacerate.

Spikes from 3 cm. up to 10 cm. or even longer, capillary. *Spikelets* very small, about 1.5 mm. long, shortly pedicelled,

about their own length distant from one another. *Lower glume* .75 mm. long, linear-lanceolate; upper glume about 1.25 mm. long; lemmas a little shorter, three-nerved, marginal nerves microscopically hairy; palea under 1 mm. long, re duplicate. *Grain* .5 mm. fusiform-oblong; pericarp adherent but slightly produced at each end.

Collected in CACHAR flowering in May.

2. Leptochloa chinensis Nees in Syll. Ratisb. I (1824) 4.

An annual, but much stouter plant than the former. *Stem* erect from a geniculate base, up to 5 mm. thick and 100 cm. tall. *Leaves* 15-40 cm. long, ligule short lacerate.

Inflorescence a panicle up to 30 cm. long; branches numerous, slender, simple, erect or spreading up to 10 cm. long. *Spikelets* about 2.5 mm. long, 4-6-flowered. *Lower glumes* lanceolate-subulate, .7 mm long; upper glume lanceolate up to 1.3 mm. long; lemmas broader lanceolate, 1.2 mm. long, 3-nerved, slightly pilose on the marginal nerves. *Grain* loose, obtusely trigonous, subrugose.

Very similar to *L. filiformis* and may only be a robust form of that plant. SURMA VALLEY.

8. TRIPOCON Roth.

Spikelets many-flowered, (florets, all but 1 to 2 terminal, perfect), 2-seriate and unilateral on a very slender terminal spike, not jointed at the base; rhachilla produced between the lemmas, jointed at the base. *Lower and upper glumes* unequal, distantly superposed, 1-nerved, empty, persistent; lower glume usually lodged in a furrow of the rhachis, and toothed or lobed on one side; upper glume entire or notched below the mucronate or apiculate tip. *Lemmas* ovate, dorsally convex, 2-fid and awned in the cleft, or 4-fid with the outer lobes awned, the inner membranous and rarely awned; palea broad or narrow, complicate. *Lodicules* 2. *Stamens* 3. *Styles* very short. *Grain* very narrow, free.

Slender densely tufted grasses. *Leaves* usually convolute.

Key to the species of *Tripogon*.

Lemmas 2-fid with an interposed awn, the lobes awned or not.

Awn as long as or longer than the lemma. 1. *trifidus*.

Awn shorter than the lemma. 2. *jacquemontii*.

Lemmas 4-fid, outer lobes awned or not, inner membranous. 3. *filiformis*.

1. *Tripogon trifidus* Munro ex Stapf, Kew Bull. (1892) 85.

A perennial. *Culms* erect, tufted, clothed at the base with old sheaths, smooth and glabrous. *Leaf-blades* setaceous, 15-75 cm. long, smooth and glabrous, ending in a capillary point; sheaths persistent ribbed, smooth and glabrous, rarely a few hairs at the mouth; ligule short.

Inflorescence a simple spike, 5-30 cm. long; rhachis somewhat flattened, angled, smooth and glabrous. *Spikelets* 4-1 cm. long, 6-10-flowered, pale olive-grey in colour, narrowly elliptic in shape, shortly pedicelled. *Lower glume* 1.5-2 mm. or more long, lanceolate, acuminate or aristate, broadly lobed on one side, the lobe sometimes being detached; upper glume 4.5-5.5 mm. long, lanceolate-acuminate, 2-toothed with a short awn; lemmas bearded at the base, 4.5-5 mm. long, lateral lobes simple, lanceolate and awned, or irregularly toothed on the inner margins, or rarely with a small tooth at the base inside; awn scabrid up to 1 cm. long; side awns short, 3-nerved; palea 3.5 mm. long, 2-nerved, broadly oblong. *Anthers* 3, 1.3 mm. long, linear.

Common in the beds of hill rivers up to 3,000 ft. Also in the KHASI, JAINTIA and NAGA HILLS at 6,000 ft.

2. *Tripogon jacquemontii* Stapf in Kew Bull. (1892) 85.

Perennial. *Culms* erect, tufted, slender, 16-30 cm. high, smooth and glabrous. *Leaves* mostly basal, filiform, convolute, setaceous, 5-16 cm. long; sheaths loose, papery; ligule short.

Spikes terminal, solitary, slender; spikelets narrowly oblong, secund, appressed or finally spreading, up to 1 cm. long. *Lower glume* lanceolate, 2.5 mm. long, membranous,

1-nerved, lobed on one side, the nerve being produced into a short awista; upper glume ovate-lanceolate, membranous, 4 mm. long, 1-nerved; lemmas 4 mm. long, shortly bearded at the base, 3-nerved, broadly ovate; side lobes not awned but may be lacerate; awn about half as long as the lemma; rhachilla rather flexuous, spikelets spaced; palea broad, truncate; keels scaberulous. *Caryopsis* narrowly oblong, terete, glabrous.

There are no specimens from ASSAM at Kew, but as the grass has been collected in BENGAL, close to the boundary, it will doubtless be found also in ASSAM.

3. *Tripogon filiformis* Nees ex Steud. Syn. Pl. Glum. (1854) 301.

A densely tufted perennial. *Culms* slender, up to 15 cm. high, smooth and glabrous. *Leaf-blades* convolute, filiform, setaceous, smooth and glabrous except for a few hairs at the base, as long as the stem; sheaths papery, persistent; ligule minute.

Inflorescence a simple spike, of many spikelets which are usually secund on the simple rhachis. *Lower glume* lanceolate, 2.5 mm. long, lobed on one side, membranous, 1-nerved; upper glume narrowly lanceolate, membranous, 1-nerved, 4.5 mm. long, nerve produced into a short awista. *Lemmas* 3.5 mm. long, awn 7-8 mm. long, the lemma is 3-nerved, the side nerves are both carried out into short awns and between those two awns and the central awn are two small hyaline lanceolate lobes which are possibly the only distinguishing feature between this species and *T. trifidus*.

NAGA, KHASI and JAINTIA HILLS. Often found on rocks in the hill rivers at the foot of the hills at 500 ft.

Var. *tenuispica* Hook. f. F.B.I. VII (1897) 288.

Bank of the Nanteilek river. NAGA HILLS, 2,000 ft.

9. NEYRAUDIA Hook. f.

Spikelets small, 4-8-flowered in an effuse, decompound, nodding panicle, laterally compressed; lowest lemma sometimes glabrous, epaleate and neuter; rhachilla shortly bearded below the lemmas, jointed at the base (above the empty lemma if present) and between the lemmas. *Glumes* and

lemmas membranous; upper and lower glumes unequal, lanceolate, 1-nerved; lemmas elongate-subulate, more or less recurved, ending in a very slender tip with two setaceous points and a scabrid interposed awn, 3-nerved, lateral nerves submarginal, penicillate with long hairs; palea oblong, keels scaberulous. *Lodicules* 2, obovate or cuneate. *Stamens* 3, anthers linear. *Ovary* shortly stipitate, oblong; styles terminal, stigmas feathery. *Grain* linear, terete, loose in the lemma.

Perennial leafy grasses. *Leaves* long, flat.

Neyraudia reynaudiana (*Kunth*) *Keng* in Hitchc., Amer. Jour. Bot. 21. (1934) 131. Syn. *Arundo reynaudiana* Kunth in Rev. Gram. II. 275; *Neyraudia madagascariensis* Hook. f. var. *zollingeri* Hook. f. F. B. I. VII (1897) 305.

A reed-like, perennial grass up to 4 m. tall. *Clumps* thick, terete, smooth and shining. *Leaf-blades* attaining a length of 60 cm., 1·2-·5 cm. wide, sometimes narrow and sub-involute, sheaths woolly at the throat and on the collar; ligule fimbriate.

Inflorescence a large nodding panicle, silvery-olive-grey in colour. *Spikelets* 4-8-flowered, the lowest 1 or 2 lemmas empty and resembling the glumes, 6-8 mm. long, rather short-pedicelled along the numerous filiform panicle branches; rhachilla produced, but only bearded below the lowest fertile lemma. *Glumes* sub-equal 2-2·5 mm. long, lanceolate, 1-nerved; empty lemma 3·5 mm. long, awnless, perfectly glabrous, obscurely 3-nerved. *Lemmas* 3-nerved, 4 mm. long, lateral nerves penicillate with long white hairs, more or less recurved, very slender, narrowed into the more or less recurved, not twisted, scaberulous awn with two bristles at the base; palea hyaline, 2-toothed, keels minutely ciliolate; callus, the upper portion of each node of the rhachilla, jointed with the latter, densely shortly bearded; awn 1 mm. antrorsely scabrid, recurved.

Common in GOALPARA district.

7. SPOROBOLEÆ.

Annual or perennial herbs; leaf-blades narrow; spikelets all alike, hermaphrodite, 1-flowered, small, pedicelled in open or contracted panicles; rhachilla disarticulating above the glumes, very rarely produced beyond the floret; glumes more or less persistent, as long as the floret or more often with the lower or both shorter, nerveless or 1-nerved; lemmas awnless, thinly membranous like the glumes, not changed at maturity, 1- to 3-nerved with the side-nerves when present delicate, frequently olive-grey, usually shining; stamens 1 to 3; grain loose between the lemma and palea, often free in the delicate pericarp.

SPOROBOLUS R. Br.

Spikelets usually very small, variously panicled, not articulated on the pedicels; rhachilla more or less readily disarticulating above the glumes, not produced, or very rarely continued as a bristle. *Floret* one, hermaphrodite. *Glumes* 2, delicately membranous, lower usually smaller and nerveless, upper 1-nerved, falling away one after the other. *Lemma* more or less resembling the upper glume, 1-nerved or more or less distinctly 3-nerved. *Palea* almost as long as the lemma, 2-nerved, folded between the nerves, often split by the developing grain. *Lodicules* 2, broadly cuneate, glabrous, thin. *Stamens* 3, rarely 2. *Ovary* glabrous; styles short, distinct terminal; stigmas plumose. *Caryopsis* free, falling out, or retained and dehiscing; pericarp thin, usually swelling in water, rigid, dehiscing or the inner layers mucilaginous when wetted and adherent, or the whole pericarp adnate and indistinct; hilum small, punctiform, basal; embryo rather large.

Perennial, rarely annual grasses, with flat or convolute leaves.

Key to the species of *Sporobolus*.

Glumes shorter than the lemma; perennials.

Branches of the panicle bare at the base. . . *I. S. diander*.

Branches of the panicle spiculate to the base. 2. *S. indicus*.
 Lower glume shorter than upper glume and lemma; annuals or perennials.

Panicle spike-like :—

Annual	..	..	..	3. <i>S. piliferus</i> .
Perennial	..	..	..	4. <i>S. tremulus</i> .
Panicle loose.	..	..	..	5. <i>S. coromandelianus</i> .

1. **Sporobolus diander Beauv.** Ess. Agrost. (1812) 25.

A slender, perennial grass with tufted stems. *Culms* 25-30 cm. high, smooth and glabrous. *Leaves* very narrow, up to 25 cm. long, 2-3 mm. wide, glabrous with entire margins, usually flat, gradually tapering to a point, sometimes convolute; sheaths smooth, ribbed, the lower short, the upper long; ligule a line of hairs.

Inflorescence a pyramidal panicle, with spreading (always when mature) or sub-erect, solitary or fascicled branches, somewhat flexuous, often without spikelets at the base. *Spikelets* minute, spindle-shaped, 1.5 mm. long or less. *Lower glume* ovate-truncate, nerveless, less than .5 mm. long; upper glume ovate-lanceolate, (not truncate), sometimes erose, up to 1 mm. long, nerveless; lemma 1.5 mm. long, ovate, obscurely 1-nerved; palea equally long. *Lodicules* 2. *Stamens* 2 or 3. *Ovary* less than .5 mm. long, glabrous; stigmas spreading, plumose. *Grain* subtruncate, pericarp somewhat adherent.

Very common throughout the province; from the plains up to 7,000 ft.

2. **Sporobolus indicus R. Br.** Prod. (1810) 170.

Culms 50-120 cm. tall, tufted, rather slender, erect, glabrous and smooth throughout except where noted; the filiform leaves at the base often as long as the plant. *Leaf-blades* 15-50 cm. long, 1.5-3 mm. wide, flat at the base or involute towards the long-attenuate filiform tip, especially those at the base and on sterile shoots; sheaths longer than the internodes, the junction with the blade often very obscure, often with a small tuft of hairs at the throat; ligule a line of very short hairs.

Inflorescence a panicle 6-40 cm. long, included at the base or long-exserted, sub-cylindric, 3-6 mm. wide, pale green in colour (often dark owing to fungus attack) the branches commonly less than 2.5 cm. long, erect or appressed; the spikelets crowded on one side of the branch or branchlets. *Spikelets* 1.5-2 mm. long, pale green, seated on short pedicels shorter than the spikelets. *Glumes* unequal, minutely rfinged, nerveless or the upper 1-nerved, thin, the lower 1/3 the length of the spikelet, the upper twice as long as the lower. *Lemma* slightly longer than the broad, obtuse palea, both thin and hyaline. *Caryopsis* soon falling from the lemma and palea, reddish, often adhering to the panicle by the viscid pericarp, a ripe panicle being often dotted with the small, dark reddish grains.

A very common grass all over the province, ascending in the hills to 5,000 ft.

2a. *Sporoholus poirettii* (Roem. et Schult.) Hitch.
Bartonia XIV (1932) 32.

A perennial grass. *Culms* 60-90 cm. tall, densely caespitose, stout, with long internodes and glabrous nodes. *Leaves* crowded near the base of the culms, 30-60 cm. long, very slender, wiry flexuous, convolute (rarely flat), with long filiform tips, quite smooth; sheaths smooth, ribbed; ligule a ridge of minute hairs.

Inflorescence a panicle up to 45 cm. long by 20 mm. wide, often interrupted; branches very short, erect, densely crowded on a smooth slender rhachis, densely spiculate to the base with imbricate green spikelets. *Spikelets* 2.2-2.5 mm. long, seated on very short pedicels. *Lower glume* broadly oblong, nerveless, hyaline, .5 mm. long; upper glume oblong, hyaline, nerveless, 1 mm. long. *Lemma* as long as the spikelet, broadly ovate, 1-nerved; palea medially plicate. *Stamens* 3. *Grain* 1.2 mm. long, obovoid, quadrangular, truncate, red-brown, rugulose, enclosed in the loose pericarp.

A common grass up to 5,000 ft.

Some of the Assam specimens are extremely like this grass. As Hitchcock remarks (*Grasses of the United States*, 1935) this species has been referred to the Australian grass *S. elongatus* R. Br. which

seems to be distinct and different in its looser panicle. The same author states with regard to *S. indicus* R. Br., the species of the Flora of British India, that the two are very similar, but the latter has more slender blades especially at the base, and the panicle branches are longer, more slender, less densely flowered, loosely ascending to somewhat spreading, and the panicle is not spikelike. As far as the Assam specimens are concerned there is great variance in the panicle but on the whole they are spikelike.

3. Sporobolus piliferus Kunth, Enum. Pl. I (1838) 211.

A densely tufted annual grass. *Culms* erect, often from a geniculate base, 5-35 cm. long. *Leaves* flat, sparsely hairy, gradually tapering to the tip, sometimes convolute, margins of the blades serrulate near the base and sometimes as far as the tip; ligule a ring of dense hairs.

Inflorescence a linear, narrow, strict, dense-flowered, often interrupted panicle, 3-9 cm. long. *Lower glume* lanceolate-truncate .5 mm. long, nerveless; upper glume lanceolate, 1.75 mm. long, slightly shorter than the upper glume, ovate-lanceolate, 1-nerved; palea narrowly oblong, as long as the lemma truncate. *Lodicules* 2. *Stamens* usually 2. *Caryopsis* 1 mm. long, brown, ovate, apiculate at the upper end.

Common in the hills, 4-6,000 ft.

4. Sporobolus tremulus Kunth, Rev. Gram. I (1829) 67.

A perennial grass erect or prostrate from a hard, knotted, stoloniferous rootstock; stolons 15-45 cm. long, stout or slender, leafy, flexuous. *Culms* 2.5-20 cm. long, wiry, smooth and glabrous. *Leaf-blades* short, 1.5 cm. long, often rigid, tapering to a sharp, pungent point, hairy at the base, flat or convolute; sheaths striate, glabrous; ligule a ring of hairs.

Inflorescence a narrow, sub-spiciform panicle, 2.5-12 cm. long, often included in the uppermost leaf-sheath, branches erect, very rarely a few spreading, sometimes flexuous. Spikelets aggregated, dense, seated on very short pedicels, pale green or white in colour, 1.5-2.5 mm. long. *Lower glume*

hyaline, 1-nerved, lanceolate, about 1·1·6 mm. long; upper glume 1·5·2·5 mm. long, lanceolate, a little broader than the lower, 1-nerved; lemma 1·5·2·5 mm. long, 1-nerved, similar to the upper glume, subtruncate; palea as long. *Stamens* 3. *Grain* broadly oblong, laterally compressed, rounded at both ends, covered with the debris of the pericarp, very smooth, yellowish brown.

There is one sheet of this grass at Kew, labelled ASSAM. It has not been collected since.

5. Sporobolus coromandelianus (Retz.) Kunth,
Rev. Gram. I (1829) 68.

A densely tufted annual with many leafy stems spreading from the root. *Leaf-blades* 2·5·7·5 cm. long flat, tapering from a ·5 mm. wide base gradually to the fine tip, spinullosely toothed on the margins; base somewhat cordate; lower sheaths short, terete or compressed, the upper long, hairy at the mouth; ligule a short membranous ridge, lacerate, with fine close-set hairs.

Inflorescence usually a short, dense pyramidal panicle, occasionally loose and spreading; branches capillary in rather distant whorls of 3-6, horizontally spreading, upper branches sometimes alternate or fascicled, naked below, sparingly shortly divided upwards; peduncle glandular above the lowest whorl. Spikelets minute, scarcely 1·25 mm. long, seated on short pedicels. *Lower glume* less than ·5 mm. long, nerveless; upper glume ovate-lanceolate, 1·25 mm. long, 1-nerved. *Lemma* ovate-lanceolate, not so broad as the glume and a little shorter. *Lodicules* 2. *Stamens* 3. *Caryopsis* up to ·5 mm. long, cylindrical.

Not recorded from ASSAM so far; it will, however, most certainly be found in the plains of SYLHET, GOALPARA and DARRANG.

8. CHLORIDEÆ.

Spikelets usually laterally compressed, 1- to few-flowered with the floret hermaphrodite and with or without imperfect florets above or below it, sessile or sub-sessile in one or two rows on one side of the continuous (rarely jointed) rhachis of solitary, digitate or scattered spikes or spike-like racemes, or in a fascicle of few spikelets; rhachilla disarticulating above the glumes, rarely below them; glumes usually persistent; lemmas membranous to chartaceous, entire, emarginate or 2- to 4-lobed, awnless or awned 1- to 3-nerved with the lateral nerves near the margins and often ciliate; lodicules 2, rarely suppressed; stamens usually 3; caryopsis enclosed in the scarcely changed lemma and palea.

Annual or perennial herbs; leaf-blades narrow.

Key to the genera of *Chlorideæ*.

Spikelets awned.	..	..	..	1. <i>Chloris</i> .
Spikelets unawned :—				
Spikes digitate.	..	..	..	2. <i>Cynodon</i> .
Spike solitary.	..	..	..	3. <i>Microchloa</i> .

1. CHLORIS Sw.

Spikelets of 2-4 florets, sessile, crowded, unilateral, 2-seriate on a slender rhachis; rhachilla disarticulating above the glumes, tough between the lemmas, more or less produced; lowest floret hermaphrodite, the 2nd male or barren, the following if present barren, often minute. *Glumes* 2, persistent, narrow keeled, acute and mucronate, very thin, or broad, and the upper obtuse, more or less bilobed and rounded on the back. Hermaphrodite floret; lemma narrow or broad, 3-nerved, acute or obtuse, minutely 2-toothed, usually awned from below the apex, often ciliate; palea almost equalling the lemma in length, 2-keeled; lodicules 2, minute, delicate, glabrous; stamens 3; ovary glabrous, styles distinct, short; stigmas laterally exserted. Male floret; lemma and palea as in the hermaphrodite floret but smaller.

and glabrous. Rudimentary florets glabrous, awned or awnless, small to very small, usually without a trace of a palea. *Caryopsis* oblong; triquetrous; embryo rather large, hilum punctiform, basal.

Perennial, rarely annual, erect or decumbent herbs; leaves usually flat, sometimes complicate or convolute.

It is not unlikely that *C. delicatula* C.B.C. may be found in the Naga Hills as it occurs in Upper Burma; also *C. polystachya* Roxb., found in Bengal, may occur in Lower Assam.

Key to the species of *Chloris*.

Empty lemmas above the floret solitary, well developed or rudimentary.

Empty lemma represented by a fine arista. 1. *C. incompleta*.

Empty lemma oblanceolate, truncate. . . . 2. *C. virgata*.

Empty lemmas above the floret 2 or 3:—

Spikelets 3 mm. long. 3. *C. guyana*.

Spikelets 2.5 mm. long. 4. *C. barbata*.

1. *Choris incompleta* Roth. Nov. Sp. (1821) 60.

A perennial grass. *Culms* usually erect but sometimes procumbent, stout or slender, 15 cm. to 1 m. tall. *Leaf-blades* 10-25 cm. long, 4-6 mm. broad, flat, linear, terminating in a fine point, glabrous except for a few hairs near the mouth of the sheath, scabrid; sheaths glabrous, striate, sometimes with a fringe of hairs along the outer margin; mouth hairy; ligule a palisade of long hairs.

Inflorescence consisting of 4-10 digitate, slender, spreading spikes of awned florets; rhachis scabrid. *Lower* glume linear-lanceolate, acute, 2.2-2.5 mm. long, 1-nerved, scabrid on the keel; upper glume lanceolate, membranous, 5-6 mm. long, 1-nerved, 2-toothed at the apex, with the nerve produced between the teeth into a short awn 1.2 mm. long, scabrid on the keel. *Lemma* oblong-lanceolate, 5.5-5 mm. long, scabrid on the back and margins, 2-toothed at the apex, awned with a median scabrid awn up to 9 mm. long; callus bearded; palea hardly as long as the lemma, oblong, acute or truncate at the apex, scaberulous on the keels; rhachilla produced, awnlke and scabrid, bearing either a rudimentary,

awned floret or its position indicated by a thickening at the apex; anthers small: grain free within the lemma and palea.

Plains of SYLHET and lower foothills of the KHASI HILLS.

2. Chloris virgata Sw. Flor. Ind. Occ. I. (1797) 203.

A perennial grass with stout, somewhat flattened stems 15-50 cm. long, sometimes creeping and rooting at the nodes below, finally erect. Leaves flat, glabrous, hairy near the throat, 5-25 cm. long, up to 4 mm. broad, tapering gradually to an acute tip; sheaths somewhat loose, smooth and glabrous; ligule a narrow, truncate, membranous appendage.

Inflorescence consists of 4-9 spikes, 2·5-3·5 cm. long, digitately arranged; when young the inflorescence is enclosed in the topmost leaf sheath; rhachis capillary, angled, scabrid. *Spikelets* 3-4 mm. long, arranged in two rows, shortly stalked. *Lower* glume 2 mm. long, 1-nerved, scabrid on the keel; upper glume 3-4 mm. long, oblong-lanceolate in shape, keeled, 1-nerved, scabrid on the keel, glabrous, 2-fid at the apex, with the nerve produced into a short scabrid awn. *Lemma* 2·5-3·5 mm. long, oblong lanceolate, bifid at the apex with the nerve produced as a scabrid awn up to 7 mm. long, bearded at the base, long ciliate on the margins in the upper half almost to the tip, sparingly ciliate in the lower half, grooved on both sides of the dorsal nerve and covered with short appressed hairs: rhachilla produced carrying a well-developed or rudimentary, second lemma: palea oblong-lanceolate, minutely 2-toothed at the apex. *Stamens* 3. *Lodicules* 2. *Caryopsis* shining, trigonous, 1·5 mm. long.

Reported from ASSAM by Jenkins; no locality given.

3. Chloris gayana Kunth, Rev. Gram. I 39, 293, t. 58.

A perennial or annual grass, 60-120 cm. tall. *Culms* erect, geniculately ascending or prostrate at the base, simple or branched, often emitting fascicles of barren shoots or short runners from the lower nodes, often robust, 3-9-noded, compressed below, glabrous, smooth. upper internodes usually

exserted; sheaths glabrous or sparingly hairy near the mouth, smooth, the lower strongly compressed, keeled, keels sometimes scabrid, the uppermost sometimes tumid; ligules very short, membranous, long hairy; blades linear, long-tapering to a fine point, 15 to more than 30 cm. long, by 7-10 mm. broad when expanded, flat or folded, glabrous or hirsute near the base, green, smooth below, rough above and on the margins.

Inflorescence consisting of 6-15 spikes, umbellated, sessile, sub-erect, rarely spreading, 5-8 cm. long, greenish or brownish; rhachis scabrid. *Spikelets* 3 mm. long, 3-4 flowered, shortly 2awned, glumes very unequal; the lower ovate-lanceolate, acute, sub-hyaline, 1.1-1.5 mm. long; the upper oblong, obtuse, mucronate 2-3 mm. long, firmer, scaberulous. *Lowest floret* hermaphrodite; lemma oblong, sub-obtuse or acute, minutely 2-toothed, ciliolate along the marginal nerves and shortly bearded below the tip or almost glabrous, with a (sometimes minutely hairy) groove on each face; awn as long as, or slightly longer than the lemma, straight; callus minutely bearded; palea glabrous, keels scabrid; anthers 1.5 mm. long. *Upper floret* barren, like the lower, but glabrous, 2 mm. long; awn 2 mm. long or less. *Third (and fourth) lemma* rudimentary, cuneate in profile, empty, awnless.

Introduced as a fodder grass.

4. *Chloris barbata* Sw. Flor. Ind. Occ. I (1797) 200.

A perennial grass. *Culms* stout from a geniculate base, 30-100 cm. tall, simple or branched, rooting at the nodes below; nodes often bearing large tufts of leaves having compressed, equitant sheaths. *Leaf-blades* flat, sometimes folded, 5-50 cm. long, up to 5 mm. wide, linear, tapering to an acute point, with a few long hairs near the base, otherwise glabrous; sheaths compressed, rather loose, glabrous with a tuft of hairs at the mouth; ligule a narrow membranous ridge.

Inflorescence consists of 5-15 digitately arranged spikes of spikelets in rows on one side of an angled, scabrid rhachis. *Spikelets* usually purplish in colour, up to 2.5 mm.

long. *Lower glume* strongly keeled, scabrid on the keel, 1.75 mm. long, lanceolate-acute, 1-nerved; upper glume 2.25 mm. long, 1-nerved, keeled, scabrid on the keel, otherwise membranous, ending in a very short awn. *Lemma* broadly ovate, 2 mm. long, 3-nerved, densely bearded on both sides of the upper half of the margins; awn 6 mm. long, scabrid; palea oblanceolate, 2 mm. long. The rhachilla is produced, 1 mm. long, and seated upon it are two empty lemmas, the lower cuneiform in shape, 3-nerved, awned from the back, ciliate above the middle, the upper shortly awned, 3-nerved glabrous and globose. *Stamens* 3. *Lodicules* 2. *Caryopsis* 1.75 mm. long.

Plains of the SURMA VALLEY.

2. CYNODON Rich.

Spikelets all alike, laterally compressed, alternately 2-seriate, imbricate, not jointed at the base, 1-flowered, secund on a slender rhachis of which 2-3 are fascicled or umbelled to form the inflorescence; rhachilla jointed above the glumes, produced or not. *Glumes* sub-equal, thin, keeled, acute or mucronate, persistent or separately deciduous. *Lemma* broader than the glumes, firmly membranous, boat-shaped, 3-nerved, keel ciliate, awnless; paleas 2-keeled, containing a bisexual floret. *Lodicules* 2, minute. *Stamens* 3. *Styles* 2, free. *Grain* oblong, free within the lemma and palea.

Creeping perennial grasses with erect culms and narrow flat, or complicate leaves.

Cynodon dactylon Pers. Syn. I (1805) 85.

A perennial grass extensively creeping by scaly rhizomes or by strong flat stolons. *Culms* up to 30 cm. tall, slender, glabrous smooth. *Leaves* conspicuously distichous on the barren shoots and at the lower part of the culms; blades linear, finely acute, 2-15 cm. long, up to 3 mm. wide, rigid or flaccid, folded, convolute or flat, more or less glaucous, glabrous or hairy, smooth on the lower surface, scaberulous above; sheaths smooth; ligule a conspicuous ring of white hairs.

Inflorescence of 4-5 fascicled spikes 1.5-5 cm. long;

rhachis pubescent at the base, keel and margins scabrid, or the margins smooth. *Spikelets* light green or purplish in colour, 2·2-3 mm. long. *Glumes* lanceolate, acute to subulate-mucronate, the lower 1·25-1·3 mm. long, the upper usually longer, keels scabrid or smooth. *Lemna* firm, obliquely oblong to semi-ovate, sub-obtuse or minutely apiculate, about 2·5 mm. long, ciliate on the keel; keels of palea scaberulous: rhachilla often prolonged beyond the palea as a slender naked bristle, sometimes bearing a rudimentary lemma. *Anthers* oblong, 1·25 mm. long. *Grain* 1·25 mm. long.

Very common in plains and hills, ascending to 6,000 ft. An excellent fodder grass of which the seed can be eaten in times of want. Often gregarious on lightly trodden paths. Extensively used as a lawn grass in the humid climate of ASSAM.

3. MICROCHLOA R. Br.

Spikelets very narrow, minute, 1-flowered, 2-seriate and secund on a solitary, terminal, filiform somewhat curved rhachis, not jointed at the base. *Glumes* subequal, membranous, 1-nerved, persistent, linear-lanceolate in shape, acute; lemma on a very short rhachilla which is not produced and is jointed just above the glumes, hyaline, very small, oblong, 2-nerved; palea as long, 2-keeled, keels ciliate. *Lodicules* 2, truncate. *Stamens* 3; anthers linear. *Styles* distinct. *Caryopsis* oblong-fusiform, glabrous, free within the lemma and palea.

Slender perennial grasses with filiform convolute leaves.

Microchloa indica Beauv. Agrost. (1812). Syn. *M. setacea* Br. Prod. I (1810) 208.

A tufted perennial grass (often annual). *Culms* very slender, terete, smooth and glabrous, usually unbranched, shining. *Leaves* crowded at the base; blades filiform, sub-setaceous tapering to a fine point, up to 15 cm. long, curved glabrous or very sparsely hairy; sheaths tight, shorter than the internodes, smooth and glabrous, striate; ligule a narrow, ciliate rim.

Inflorescence a slender, dorsally rounded, solitary, terminal, filiform, curved spike, 5-25 cm. long, upon which is arranged a secund biserrate row of spikelets. *Spikelets* 3 mm.

long; rhachilla jointed above the glumes and not produced. *Lower glume* and upper glume equal, lanceolate in shape, 1-nerved, keeled, persistent, 2.5 mm. long. *Lemma* ovate, 1.5 mm. long, densely hairy on the back; palea narrower than the lemma, hairy on the nerves, 2-toothed at the apex. *Stamens* 3; anthers 1 mm. long. *Lodicules* 2. *Grain* oblong, fusiform, slightly compressed, glabrous, 1.25 mm. long.

A common grass in the hills about 4,000 ft. It is often gregarious on bare areas, particularly in road cuttings.

9. AVENEÆ.

Annual or perennial herbs; leaf-blades narrow, spikelets all alike 2-7-(rarely 1-) flowered, with all the florets hermaphrodite or the uppermost often barren, or in 2-flowered spikelets rarely with the upper floret male, pedicelled in open or contracted panicles, rarely in racemes or spikes; rhachilla disarticulating above the glumes and usually between the florets; glumes persistent, rarely deciduous, mostly similar, usually as long as the lowest lemma and often as long as the spikelet enclosing the florets, membranous to chartaceous, frequently with shining margins; lemmas membranous to cartilaginous, their margins often hyaline or scarious and shining, 5- or more- (rarely 3-) nerved, awnless or more often awned from the back or from the sinus of the 2-lobed tip, the awn usually geniculate and twisted below the knee: lodicules 2; stamens 3.

Key to the genera of Aveneæ.

Lowest floret male.	1. <i>Arrhenatherum</i> .
Lowest floret hermaphrodite.	
Lemmas awned from the back.	
Awn placed more than $\frac{1}{3}$ length of lemma below the tip. Ovary hairy.	
Spikelets nodding: glumes 7-9-nerved.	2. <i>Avena</i> .
Spikelets upright; glumes 1-5-nerved. . .	3. <i>Helictotrichon</i> .
Awn placed just below the tip. Ovary glabrous.	
Glumes persistent.	4. <i>Trisetum</i> .
Glumes deciduous with spikelet. . . .	5. <i>Holeus</i> .
Lemmas awned from the sinus.	6. <i>Danthonia</i> .

1. ARRHENATHERUM Beauv.

Spikelets 2-flowered, the lower floret male, the upper hermaphrodite; rhachilla disarticulating above the glumes and produce beyond the uppermost floret; glumes rather broad and papery, the lower 1-nerved the upper a little longer than the lower, 3-nerved; lemmas 5-nerved, hairy on

the callus, the lower bearing near the base, a twisted, exserted, geniculate awn, the upper bearing a short, straight, slender awn just below the tip.

Rather tall perennial grasses with flat blades and narrow panicles.

Arrhenatherum elatius (L.) Presl., Fl. Cech. (1819)
17. Syn. *Avena elatior* Linn. Sp. Pl. (1753) 79.

An erect grass from an extensively creeping rootstock. *Culm* 1·1·5 m. tall. *Leaves* flat, broadly linear-lanceolate, scabrous, 20 cm. long, 5·10 mm. wide; ligule short, toothed.

Inflorescence a panicle, 15·30 cm. long, pale or purplish, shining; the short branches verticillate, spreading in anthesis, usually spiculate to the base. *Spikelets* 7·8 mm. long, 2-flowered; glumes minutely scabrous; lemmas scabrous; the awn of the staminate floret about twice as long as its lemma.

Introduced into Shillong.

2. AVENA LINN.

Spikelets large or very large, 1·7-4 cm. long, pendulous in open, usually very lax panicles; rhachilla hairy or glabrous, disarticulating above the glumes and between the lemmas, or only above the glumes, or not at all in cultivated forms, usually terminated by a rudimentary lemma. *Florets* 3-5; the lower 1 or 2 (rarely 3) hermaphrodite; the upper reduced, smaller, male or barren or quite rudimentary. *Glumes* 2, persistent, scarios, equal or sub-equal, acute or acuminate, rounded on the back, 7-11-nerved. *Lemmas* distinctly shorter or just equalling the glumes, sub-herbaceous with rather rigid scarios tips, acute or acuminate, bifid, with or without bristles from the lobes, 5-9-nerved, lower 1-3 awned; awn dorsal from the middle or slightly above it, kneeled and twisted below or (in the upper lemmas) imperfect; callus short, villous (or imperfect and glabrous in cultivated forms). *Palea* shorter than the lemma, 2-keeled, 2-toothed or bifid. *Lodicules* 2, rather large, hyaline, entire. *Stamens* 3. *Ovary* densely villous from the base; style distinct, extremely short or absent; stigmas laterally exserted, plumose. *Grain* oblong,

sub-terete, grooved in front, hairy, pallid, enclosed by the lemma and palea; hilum fine, linear oblong; embryo small.

Annual grasses with linear flat, flaccid blades.

Key to the species of Avena.

Spikelets mostly 2-flowered; lemmas glabrous. 1. *A. sativa*.
Spikelets mostly 3-flowered; lemmas hairy. . . 2. *A. fatua*.

1. Avena sativa Linn. Sp. Pl. (1753) 79.

Culms simple; leaf sheaths glabrous; ligules shortly ovate 3·5-6 mm. long; blades linear or lanceolate-linear, glabrous, scaberulous.

Panicles open; branches spreading equally all round or contracted and secund; spikelets 22-30 mm. long or longer, usually with a 1-awned floret at the base and one or two awnless florets above or with all the florets awnless; rhachilla tough or tardily disarticulating at the base, glabrous or almost so; glumes broad lanceolate 7-11-nerved; lemmas lanceolate, acuminate, shortly bifid or 2-4-toothed, glabrous, rarely with a few scattered hairs, the lower 17-25 mm. long; ovary hairy all over; grain tightly enclosed by the lemma and palea, free, silky all over.

Cultivated in the BALIPARA FRONTIER TRACT.

2. Avena fatua Linn. Sp. Pl. (1753) 80.

Culms solitary or few in a tuft, with few or no barren shoots; leaf-sheaths glabrous or the lower more or less hairy; ligules short, very obtuse up to 3·5 mm.; blades linear to lanceolate-linear, up to 30 cm. long by 1·5 cm. broad, glabrous or rarely sparsely hairy, scabrid.

Panicle open or contracted; branches spreading equally all round or more or less erect and sub-secund; spikelets 2·2-2·8 cm. long, with 2-3-awned florets and with or without a rudimentary, usually minute, awnless floret above them; rhachilla freely disarticulating below and more or less so between the lemmas; joints between the lemmas villous; glumes broad, lanceolate, acuminate, 7-9-nerved; lemmas lanceolate, acute, shortly 2-4-toothed; the lower 15-22·5 mm. long, usually brown below and green towards the tip, scabe-

ulous, with stiff brown hairs to the middle or sub-glabrous with the exception of the very short callus, 7-nerved, all awned except the rudimentary uppermost; awn from the middle, scabrid; column very dark, 10-17 mm. long; bristle 1·8-3·5 cm. long; anthers 2·5-3·5 mm. long; ovary villous all over; grain 7·5-10 mm. long, tightly embraced, free, silky all over.

Introduced into Shillong in grass seed of Mediterranean origin.

3. HELICTOTRICHON Bess ex Schult.

Spikelets narrowly oblong to oblong or elliptic-oblong, laterally compressed, erect or sub-erect, less often nodding, moderately large, pedicelled in open or contracted panicles; rhachilla slender, more or less long hairy, disarticulating above the glumes and between the florets, produced into a short bristle beyond the uppermost floret or ending a rudimentary lemma. *Florets* 2-6, hermaphrodite or the uppermost more or less reduced; callus short or elongated, villous. *Glumes* persistent, hyaline to scarious, or herbaceous and firm, more or less equal, acute or acuminate, more or less distinctly keeled; lower smaller, 1-3-nerved; upper 3-5 (rarely sub-7-) nerved. *Lemmas* narrowly lanceolate to lanceolate-oblong and acute in profile, enclosed by, or more often distinctly exserted from the glumes, more or less herbaceous, with hyaline tips and margins or becoming indurated, bifid, with or without bristles from the lobes, 5-11-nerved, awned from the middle or above the middle of the back; awn usually geniculate and twisted below the bend. *Paleas* oblong linear, shorter than the lemmas, 2-keeled, membranous. *Lodicules* 2, rather large hyaline. *Stamens* 3. *Ovary* hairy from the middle upwards or only at the top; styles distinct, short; stigmas plumose, laterally exserted. *Caryopsis* oblong, slightly laterally compressed, usually grooved in front, hairy at the top, rather soft, embraced by the lemma and palea; hilum linear, up to half the length of the grain; embryo small.

Caespitose perennials; leaf-blades linear, usually narrow, flat or convolute, rarely folded, sometimes setaceous; ligule hyaline; panicle narrow, erect or nodding.

Helictotrichon asperum (*Munro*) *Bor*, in Ind. For. Rec. (Bot.) I.3 (1938) 68. *Syn. Avena aspera* *Munro* ex *Thwaites*. *Enum. Pl. Zeyl.* (1864) 372. *Avenastrum asperum* *Fischer*, *Flora of Madras*, X (1931) 1802.

A perennial grass, 60 cm.-1.5 m. tall, slender or sometimes stout glabrous or smooth. *Leaf-blades* 15-30 cm. long, flat or rarely convolute, up to 1 cm. wide; sheaths smooth and glabrous or sometimes pubescent; ligules short, truncate, membranous.

Inflorescence a panicle, often nodding; main axis and branches more or less scabrid; lower branches up to 15 cm. long, solitary, geminate or fascicled. *Spikelets* 8 to 15 mm. long, ovate or ovate-oblong in outline, green and glistening. *Lower glume* 7 mm. long, lanceolate, 1- to 3-nerved; tip acute; keel strongly scabrid below the tip. *Upper glume* 9.5 mm. long, ovate-lanceolate, acute, scaberulous near the tip, 5-nerved. *Lowest lemma* 11 mm. long, ovate-lanceolate, callus hairy, dorsal surface scaberulous, with short, distant hairs along the margins, ovate-lanceolate, 7-nerved, the central nerve being continued out into a strongly kneed awn which arises from the dorsal surface, the next two nerves are produced upwards into 2 awl-like awns; awn 2.5 cm. long, often recurved, scaberulous; upper lemmas consecutively smaller and not showing prominent awl-like awns; palea 3 mm. long; tip obtuse, 2-keeled, pectinately ciliate on the keels. *Anthers* linear 2.5-3.25 mm. long. *Ovary* ovoid or pyriform, densely hirsute on tip. *Lodicules* 2-cleft.

Common in the NAGA, AKA, KHASI and JAINTIA HILLS, 4-6,000 ft.

4. TRISETUM Pers.

Spikelets rather small, 2.5-10 mm. long, usually in close, often spike-like panicles; rachilla ciliate or long hairy, very rarely glabrous; disarticulating above the glumes and between the lemmas, produced into a short bristle beyond the uppermost floret. *Florets* two to six, hermaphrodite, or the uppermost more or less reduced. *Glumes* two, persistent, equal or more or less unequal, acute, keeled, lower 1-(or like the upper more or less distinctly 3-) nerved, hyaline.

Lemmas equalling or exceeding the glumes, membranous with hyaline tips and broad margins, acutely 2-toothed, sometimes with fine short bristles from the teeth, faintly or obscurely 5-3-nerved, awned; awn from the back near the tip, fine, straight, or kneeled and twisted below; callus minute, more or less hairy or glabrous. *Palea* shorter than the lemma, 2-keeled, 2-toothed, hyaline. *Stamens* 3. *Ovary* glabrous; styles distinct, very short; stigmas laterally exserted, plumose. *Grain* oblong, whitish, soft, embraced by the usually slightly hardened back of the lemma; hilum basal, short; embryo small.

Trisetum flavescens (L.) Beauv. Ess. Agrost. (1812) 88. 153.

A tufted perennial with numerous fibrous roots which are often of a yellowish colour. *Culms* erect, striate, terete, often from a shortly decumbent base, up to 60 cm. tall, smooth and glabrous. *Leaf-blades* rather thin, linear, tapering to a fine point, often abruptly rounded at the base to the sheath, sparsely to thickly villous on both surfaces, smooth; blades 4-10 cm. long, 3-5 mm. wide; sheaths rather loose, striate, smooth and glabrous or densely covered with silky, reflexed villae; ligule short, blunt, membranous.

Inflorescense a symmetrical, open or contracted, erect panicle, golden yellow in hue; branches whorled on an erect central axis; axis striate, smooth and glabrous; branches swollen at the insertion, flexuous, capillary, naked at the base. *Spikelets* small, numerous, 2-3-flowered. *Lower* glume subulate, keeled, hyaline on the margins, 1-nerved; upper glume broadly ovate-acuminate, 4-5-5 mm. long, 3-nerved, margins hyaline, keeled. *Lemmas* ovate-lanceolate, 5-5 mm. long or less, 5-nerved, lateral nerves often indistinct, bifid at the apex, with a geniculate awn, 6 mm. long, from the dorsal surface $1/4$ to $1/3$ the length of the lemma from the tip, margins and tip hyaline, stamens 3, anthers 2-2.5 mm. long. *Rhachilla* capillary, bearded, crowned by an imperfect lemma which often bears an awn of normal length.

Introduced in fodder grass seed into Shillong (4,700 ft.) and run wild in the station.

5. HOLCUS Linn.

Spikelets in rather dense, oblong or interrupted panicles, laterally compressed, disarticulating from the tips of the pedicels; rhachilla slightly produced beyond the upper floret, disarticulating more or less readily below the lemmas; joints slender, lower curved and often appendaged.

Florets two; lower hermaphrodite; upper usually male, sometimes hermaphrodite or barren. *Glumes* two, membranous, keeled, acute or acuminate; lower 1-nerved; upper 3-nerved, sometimes awned. *Lemmas* shorter than the glumes, chartaceous, very obscurely 3-5-nerved; lower awnless; upper awned. *Palea* narrow, 2-keeled. *Lodicules* 2, delicate. *Stamens* 3. *Ovary* glabrous, styles distinct; stigmas plumose, laterally exserted. *Grain* laterally compressed, enclosed by the lemma and palea, and often adhering to the latter, soft; hilum short; embryo small.

Key to the species of *Holcus*.

- | | |
|-----------------------------------------------------------------------------------|---------------------------|
| Glumes 4.5 mm. long, awn finely serrated towards the point; rhizome absent. | .. 1. <i>H. lanatus</i> . |
| Glumes nearly 5.6 mm. long; awn serrated throughout its length; rhizomes present. | .. 2. <i>H. mollis</i> . |

1. *Holcus lanatus* Linn. Sp. Pl. (1753) 1048.

A perennial, tufted grass, 60-90 cm. tall; culms 3-4-noded, softly hairy at least below the panicle, rarely quite glabrous, villous at the nodes; the uppermost sheaths inflated; ligule membranous, oblong, pubescent, 2.5 mm. long; blades linear to linear-lanceolate, up to 15 cm. long by 5.7.5 mm. wide; the uppermost very short, flat, softly hairy.

Inflorescence a panicle, erect, oblong, 5-15 cm. long, usually contracted; rhachis, branches, branchlets and pedicels hairy; spikelets oblong, 4.5-5 mm. long, whitish or purplish; glumes almost equally long, hairy, mucronate scabrid; keels pectinate-ciliate; the lower narrower; the upper broader with prominent side nerves. *Lower floret* hermaphrodite; upper male; lower lemma obliquely lanceolate-oblong, rather more than 2.5 mm. long, with a few hairs on the keel, very obscurely 5-nerved; callus with a few long hairs; upper lemma smaller and thinner; awn shorter than the

lemma, at length recurved, rather stout, serrate only towards the point; paleas as long as the lemmas; anthers 2·2-5 mm. long.

Introduced with fodder grass seed into Shillong.

2. *Holcus mollis* Linn Syst. Nat. ed. 10.2 : (1759) 1305.

A perennial grass closely related to *H. lanatus* L. The culms are glabrous 50-100 cm. tall with vigorous slender rhizomes; sheaths except the lower glabrous; blades villous or velvety, 4-10 mm. wide; panicle ovate or oblong rather loose, 6-10 cm. long; spikelets 5-6 mm. long, glumes hairy on the nerves; awn of the second floret geniculate exserted, about 3 mm. long, serrated throughout its length.

Introduced into Shillong with grass seed from Europe.

6. DANTHONIA DC.

Spikelets small to large, laterally compressed, pedicelled in open or contracted panicles, rarely in racemes, very rarely sessile or sub-sessile in distichous secund spikes; rhachilla disarticulating above the glumes and between the florets, usually ending in a rudimentary floret. *Florets* 2-10, hermaphrodite, the uppermost (when more than 2) reduced, usually exceeded by the glumes or more or less equalling them; callus small or rather long, obtuse or acute, hairy. *Glumes* persistent, equal or sub-equal, more or less lanceolate in profile, acute or acuminate, keeled, hyaline to scarious or sub-herbaceous, 3-11-nerved. *Lemmas* rounded on the back, firmly membranous to coriaceous, more or less hairy, often with the hairs partly gathered in variously arranged tufts, 5-11-nerved, 2-lobed, awned from the sinus; lobes free, rarely more or less adnate to the awn, acute or obtuse, with or without a bristle from the tip; awn usually geniculate, mostly twisted below the bend. *Paleas* 2-keeled, mostly exceeding the insertion of the awn of the lemma, entire or shortly bifid. *Lodicules* 2, large, or sometimes small, ciliate or glabrous. *Stamens* 3. *Ovary* oblong or obovoid, glabrous; styles distinct, slender, long or short and then sometimes with the stigmatic hairs decurrent on the inner side and joining over

the top of the ovary; stigmas plumose, laterally exserted. *Grain* oblong, obovoid or ellipsoid, dorsally compressed or semi-terete, rarely almost terete; hilum obscure, oblong or linear; embryo one-third to half the length of the grain:—

Caespitose perennials, rarely annuals; ligule a fringe of hairs; blades narrowly linear to linear, or setaceous, rolled or flat; panicle often very dense.

***Danthonia eachymeriana* Jaub. et Spach.** Illustr. Pl. Orient. iv. 46.

A caespitose perennial. *Culm* 1 m. tall, smooth and glabrous, erect; base covered with the remains of old sheaths. *Leaves* linear-setaceous, very narrow (2 mm.) and up to 35 cm. long, minutely scaberulous or smooth on the upper surface, lower surface smooth, glabrous; margins cartilaginous and smooth; sheaths smooth and glabrous, striate, rather loose, a few long villae at the throat; ligule a dense ring of short hairs.

Inflorescence a contracted panicle, upper part racemose with spikelets singly pedicelled on the axis, lower branches in pairs and branched. Main axis and pedicels angled scabrous and villous or hispid on the angles. *Spikelets* 4-5-flowered, the terminal imperfect and seated on the prolongation of the rhachilla; rhacilla jointed, smooth and glabrous or a few short hairs near the top, 3 mm. long. *Lower glume* 5-nerved, lanceolate, acute, 2.5 cm. long, glistening, smooth and glabrous, tip setaceous; upper glume similar in shape, texture and size, or somewhat longer, 5-6-nerved. *Lemmas* bearded on the callus, 10 mm. long, 9-11-nerved, rounded on the back, long bearded on the margins, below and half way up, a few villae on the dorsal surface above, bifid at the apex, central nerve continued out into a stout scabrid awn 25 mm. long, the lateral lobes acute and aristate, aristae 8-14 mm. long, palea oblong, tip obtuse or truncate, 2-keeled, keels scabrid, margins infolded. *Stamens* 3, anthers 3.5-4 mm. long. *Ovary* obovoid, glabrous; styles 2 short, stigmas plumose, long, laterally exserted.

A caespitose grass so far only found on Japvo, NAGA HILLS, at 9,900 ft.

10. AGROSTEÆ.

Annual or perennial herbs, usually with slender culms; leaf-blades mostly narrow; spikelets usually alike and hermaphrodite, 1-flowered, small, mostly laterally compressed, pedicelled in open or contracted or spike-like panicles, very rarely in racemes; rhachilla disarticulating above the glumes, rarely below them, not produced beyond the floret or only as a point or bristle, glumes usually persistent, as long as the spikelet and enclosing the floret or sometimes shorter, rarely very small or suppressed; lemmas hyaline or membranous, thinner than the glumes or similar in texture, not or slightly changed at maturity, rarely indurated, mostly 3-5-nerved, awnless or awned from the back or less often from the entire or 2-lobed tip; awn geniculate or straight; stamens 3, 2, or 1; caryopsis mostly enclosed (often tightly) between the lemma and palea, rarely loose .

Key to the genera of *Agrostææ*.

Leaf-blades narrow, linear, flat, folded or rolled :—

Spikelets disarticulating above the glumes, the latter persistent :—

Inflorescence not spiciform; pedicels not minute :—

Glumes equal or nearly so, longer than the lemma; lemma awned from the back or awnless :—

Lemma glabrous or only with a few short hairs at the base, glumes not long acuminate :—

Lemma hyaline, shorter than the glumes :—

Rhachilla not produced (see *Agrostis abnormis*). 1. *Agrostis*.

Rhachilla produced, pectinate ciliate. 2. *Deyeuxia*.

Lemma coriaceous, longer than the glumes. 3. *Aulacolepis*.

- Lemma hairy or glabrous; awn basal or not; glumes long acuminate; callus long-bearded; rhachilla not produced. 4. *Calamagrostis.*
- Glumes equal or unequal, as long as the lemma or shorter; lemma awned from the tip. 5. *Muehlenbergia.*
- Inflorescence spiciform; pedicels minute. Spikelets disarticulating below the glumes, and falling entire. 6. *Phleum.*
- Glumes awnless :—
- Inflorescence a spike-like panicle. 7. *Alopecurus.*
 - Inflorescence a loose or contracted panicle. 8. *Garnotia.*
 - Glumes awned. 9. *Polypogon.*
- Leaf-blades broad, ovate, cordate; spikelets disarticulating below glumes. 10. *Sphaerocephalus.*

1. AGROSTIS Linn.

Spikelets from less than 2·5 mm. to 5 mm. long, panicled, rhachilla not produced beyond the floret or produced into a minute point or short delicate bristle, glabrous or shortly hairy. *Floret* one, hermaphrodite, shorter than the glumes. *Glumes* equal or sub-equal, usually lanceolate and acute, rarely oblong and obtuse, awnless, membranous, usually 1-nerved, keeled. *Lemma* broadly oblong, membranous, glabrous or hairy, usually truncate, 5-(rarely 3-) nerved, awned from the back or awnless; side nerves evanescent below, often excurrent into fine mucros or bristles; callus very small, glabrous, or minutely hairy or rarely bearded. *Palea* delicate, hyaline usually shorter than the lemma, or very short or obsolete, 2-nerved or nerveless. *Lodicules* 2, lanceolate, delicately hyaline. *Stamens* 3. *Ovary* glabrous; styles distinct, very short; stigmas plumose, laterally exserted. *Grain* free, enclosed in the scarcely altered floret; oblong more or less dorsally compressed, grooved in front, rarely terete; embryo short; hilum punctiform, basal.

Annuals or perennials of varying habit; blades usually flat, often flaccid; ligules membranous; panicle usually much divided, often delicate, more or less effuse or contracted, rarely spike-like; branches and branchlets fine to very fine; spikelets usually very numerous, much gaping, at least temporarily.

Key to the species of *Agrostis*.

- Callus not bearded :—
- Stems only 6 cm. tall. 1. *A. inaequiglumis*.
- Stems much taller :—
- Palea half as long as the lemma :—
- Stoloniferous. 2. *A. stolonifera*.
- Not stoloniferous. 3. *A. alba*.
- Palea short or absent :—
- Lemna awned. 4. *A. filipes*.
- Lemna awnless :—
- Tall, rather slender, leaves narrow; ligules oblong up to 3 mm. long; lemma 1.25 mm. long. 5. *A. micrantha*.
- Stem stout; leaves broad; ligules a membranous ring; lemma 1.5 mm. long. 6. *A. myriantha*.
- Callus bearded and rhachilla occasionally produced as a minute bristle. 7. *A. abnormis*.

1. *Agrostis inaequiglumis* Griseb. in Goett. Nachr. (1868) 80.

A densely caespitose grass growing at high elevations. *Culms* erect, 4.5 cm. tall, stout, stiff. *Leaf-blades* convolute, rarely flat 2-3 cm. long, smooth and glabrous; leaf-sheath rather loose and slipping from the culms, smooth, glabrous, striate; ligules 1 mm. long, membranous, erose.

Inflorescence a spiciform panicle, purplish in colour, dense flowered. 2.5-4 cm. long; rhachilla smooth and glabrous; branches short, often whorled; branchlets filiform, smooth and glabrous; pedicels 1.1-1.5 mm. long, slightly dilated at the apex, smooth and glabrous, filiform. *Spikelets* 2.5 mm. long; lower glume 2 mm. long, ovate-lanceolate, 1-nerved, minutely scabrid on the keel; upper glume 2.5 mm. long, ovate-lanceolate, 1-nerved, rarely 3-nerved; lemma 1.5 mm. long, hyaline; palea absent. *Grain* terete or spindle-shaped, 1 mm. long.

BALIPARA FRONTIER TRACT, 10,000 ft. (Kingdon-Ward).

2. *Agrostis stolonifera* Linn. Sp. Pl. (1753) 62.

An entirely glabrous perennial, with numerous creeping surface stolons, rooting at the lower nodes. *Culms* ascending

from a spreading base, the decumbent portion rooting in wet soil, 20-50 cm. tall. *Leaf-blades* flat, rolled in the shoot, varying in length and breadth, usually 1-3 mm. broad, acute at the apex, rough downwards; sheaths split, smooth and glabrous, without auricles; ligules long, erect, membranous, rounded at the apex.

Inflorescence an oblong panicle, 5-15 cm. long, pale or purple, somewhat lax; the branches or some of them spiculate from the base; spikelets 2-2.5 mm. long; glumes acute, glabrous, keel scabrous; lemma shorter than the glumes, awnless or very rarely awned from the back; palea usually half to two-thirds as long as the lemma.

Introduced in Shillong and escaped.

3. *Agrostis alba* L. Sp. Pl. (1753) 63.

Differs from *A. stolonifera* in its usually erect more robust culms, sometimes as much as 1.1-1.5 m. tall, the base erect or decumbent, with strong creeping rhizomes; blades flat, 5-10 mm. wide; panicle pyramidal oblong, reddish, as much as 20 cm. long, the branches spreading in anthesis, sometimes contracting later; lemmas rarely awned.

Introduced in Shillong and escaped.

4. *Agrostis filipes* Hook f. in F.B.I. VII (1897) 256.

A densely tufted perennial grass. *Culms* up to 35 cm. tall, erect or ascending from a geniculate base. *Radical leaves* many, tufted, 2.5-5 cm. long, subulate, caudine rather broader and longer, almost smooth; ligule a short membranous ring.

Panicle narrow, interrupted, 5-10 cm. long; branches shortly alternate, minutely scaberulous (not smooth as indicated by Hooker). *Spikelets* seated on the inflated tips of the capillary branches. *Lower glume* lanceolate, acute, keeled, scabrid on the keel, 2 mm. long; upper glume similar but shorter about 1.75 mm. long. *Lemma* ovate-truncate, 1.75 mm. long, glabrous; a scabrid geniculate awn 1 mm. long issues from the back of the lemma and is shortly exserted; nerves very obscure lemma sometimes quite hyaline; palea

minute, hyaline. *Caryopsis* ovoid, acute at the tip. *Stamens* 3, anthers short, less than .5 mm. long.

Common about Shillong, KHASI & JAINTIA HILLS, 4-6,000 ft.

Flrs. 7-8.

5. Agrostis micrantha Steud. Syn. Pl. Glum. (1854) 70.

A perennial tufted grass. *Culms* up to 1 m. tall, rather slender, sometimes stout below, rather scaberulous. *Leaf-blades* 3-15 cm. long by 3-4 mm. broad, flat, sometimes rolled, scaberulous; sheath scaberulous; ligule membranous, oblong up to 3 mm. long.

Panicle 10-25 cm. long, contracted or somewhat effuse. *Spikelets* small, 1.75 mm. long, seated on the clavate pedicels on capillary, scaberulous branches, the lower of which are whorled. *The glumes* are subequal, 1.75 mm. long or up to 2 mm. 1-nerved, keeled and scabrid on the keel. *Lemma* 1.5 mm. long, ovate-truncate, 5-nerved, sometimes very obscurely glabrous, callus naked. *Palea* rectangular, hyaline, not exceeding .5 mm. long. *Stamens* 3, anthers .6 mm. long.

Common in the KHASI HILLS, 5-6,000 ft.

6. Agrostis myriantha Hook. f. in F. B. I. VII (1897) 257. Syn. *A. platyphylla* Mez in Fedde. Rep. Sp. Nov. XVII (1920) 302.

A perennial grass. *Culms* up to 1.6 m. tall, stout, leafy. *Leaves* broadly linear-lanceolate, 10-30 cm. long, 3 mm.-1 cm. broad, scaberulous; ligule a narrow membranous ring.

Panicle 15-30 cm. long, contracted in flower, many- and dense-flowered; rhachis rather stout, branches fascicled or whorled, often spiculate to the base but sometimes naked for half their length; pedicels short, smooth, clavate. *Glumes* very nearly equal, 1-nerved, scabrous on the keels or not, 2 mm. long. *Lemma* perfectly glabrous, 1.25 mm. long, ovate, truncate, awnless, 5-nerved. *Callus* naked. *Palea* minute.

Common in the KHASI HILLS, 5,000 ft.

Var. *khasiana* seems to be a more robust plant than typical *A. myriantha* and is probably not a valid variety.

Maoling Kaden, KHASI HILLS, 4,000 ft.

7. *Agrostis abnormis* Munro ex Hook f. F. B. I. VII (1897) 268. Syn. *Deyeuxia abnormis* Hook. f. in F. B. I. VII (1897) 268. *Agrostis pleiophylla* Mez in Fedde, Rep. Sp. Nov. (1920) 301.

A densely tufted perennial, with stems 15-45 cm. tall or almost a scrambler. Leaves 15-20 cm. long by 4-6 mm. wide, rather rigid, scaberulous, flat or convolute; sheaths somewhat scaberulous; ligule short, rounded.

Inflorescence a contracted or effuse panicle; branches and branchlets glabrous and minutely scaberulous (Hooker states that the branches are smooth; this is not so). *The spikelets* are seated upon somewhat clavate pedicels which show a few spinose hooks here and there under a power of $\times 22$. *The glumes* are subequal, 1-nerved, 2 mm. long, keeled, definitely scabrid on the keel. *The lemma* is 2 mm. long, not erose, 5-nerved, glabrous; palea ovate-oblong, hyaline, 1.5 mm. long. *The callus* is heavily bearded in front of the palea with hairs up to 1 mm. long. *The rhachilla* is either entirely missing or only vestigial beyond the lemma. *Caryopsis* ovate black purple, 1.2-5 mm. long rough.

Very common on the Shillong plateau. 5-6,000 ft.

A variable and most unsatisfactory plant. This grass was placed in *Deyeuxia* by Hook. f. on the grounds that the rhachilla is produced. This, however, is not a constant character and the grass bears no resemblance to other species of *Deyeuxia*. It is, in appearance, an *Agrostis* and has been described as such by Mez under the name *A. pleiophylla*. I am, therefore, removing this grass from the genus *Deyeuxia* and restoring it to *Agrostis* where it was first placed by Munro.

2. DEYEUXIA Clar.

Inflorescence a panicle often large and effuse occasionally small and contracted. *Spikelets* disarticulating above the more or less persistent glumes, 1-flowered, subterete; glumes unequal, scaberulous, lower 1-nerved, upper 3-nerved. *Lemmas* shorter than the glumes, hyaline, truncate, crenate or cleft, paleate, 5-nerved, awned from the base or further up the dorsal surface, never from the tip, nerves parallel, the median usually prolonged into the awn; palea hyaline, oblong, narrow; rhachilla jointed at the base, produced beyond the lemma,

penicillate with long white hairs—often as long as the lemma, very rarely capped by an imperfect floret. *Stamens* 3. *Lodicules* 2. *Styles* 2; stigmas plumose.

Perennial grasses, often stout but sometimes slender, usually found at high elevations in the tropics.

Key to the species of Deyeuxia.

Awn of lemma basal or sub-basal .. . 1. *D. elatior*.

Awn of lemma inserted above the middle :—

Panicle contracted :—

Panicle 2·5-5 cm. long, erect, purplish. . . . 2. *D. pulchella*.

Panicle up to 20 cm. long, nodding, pale. . . . 3. *D. scabrescens*.

Panicle effuse. 4. *D. nagarum*.

1. Deyeuxia elatior Hook. f. in F. B. I. VII (1897) 266.

A tall, stout, perennial grass reaching 2 m. in height, reed-like. Leaves up to 1 m. long and 1·5 cm. broad, coriaceous, closely nerved, midrib prominent beneath, glabrous or hairy beneath; sheaths hirsute or glabrescent; ligules short, scarious.

Inflorescence a panicle up to 30 cm. long by 10-15 cm. broad, effuse when mature; branches and branchlets scaberulous, whorled below. *Spikelets* lanceolate 5·5-5 mm. long. *Lower glume* 5·5 mm., 1-nerved, keeled and scabrid on the keel; upper glume 5 mm. long, 3-nerved, keeled and scabrid on the keel. *Lemma* 4·4-5 mm. long, ovate-lanceolate, obscurely 5-nerved, top erose awned; awn 7-8 mm. long arising from the lemma near its base. The *lemma* is scaberulous on the dorsal surface; palea ovate-oblong, 4 mm. long, hyaline. *Stamens* 3, anthers 2·5 mm. long.

Common in Upper Shillong, 6,000 ft. usually gregarious beside water courses.

2. Deyeuxia pulchella Hook. f. in F. B. I. VII (1897) 268.

A perennial grass. *Culms* tufted, strict, erect or shortly decumbent at the base, up to 30 cm. tall, smooth and glabrous, swollen at the base with the remains of old sheaths. *Leaf-blades* involute in the Sarameti specimens (usually flat.

according to Hooker) 13.5 cm. long, 2.5-3 mm. wide when flattened, smooth and glabrous, gradually tapering to the base; sheaths smooth, glabrous striate, rather inflated below, tight above; ligule 1 mm. membranous.

Inflorescence an oblong panicle up to 5 cm. long, shortly branched, branches scaberulous. *Spikelets* 4.5 mm. long, closely crowded, seated on short scaberulous pedicels; callus shortly bearded. *Lower glume* 4.5 mm. lanceolate, finely acuminate, scaberulous, 3-nerved; upper glume same shape and texture, 5 mm. long, scaberulous. *Lemma* 4 mm. long, ovate-oblong in shape, 5-nerved, the central nerve being continued out into a short stout awn 3 mm. long, inserted about 1/3 way down, the other four continued to the summit where they form 4 lobes, often almost setiform; palea hyaline 3 mm. long, obtuse, hyaline; rhachilla produced, 1.5-2 mm. long, penicillate with long white hairs, reaching almost to the summit of the lemma. *Stamens* 3, anthers 2 mm. long.

Piri and elsewhere in the BALIPARA FRONTIER TRACT, circa 11-13,000 ft.

3. *Deyeuxia seabeensis* Munro ex Duthie in Atkins, Gaz. North-West Prov. India (1832) 623.

A stout grass up to 1.5 m. tall. *Leaf blades* flat or convolute, 15-45 cm. long, up to 3 mm. broad; sheaths rather loose, minutely scaberulous; ligule very long, membranous, lacerate.

Inflorescence a contracted panicle up to 20 cm. long; branches and branchlets scaberulous. *Spikelets* 6.6-5 mm. long. *Lower glume* 5.5-6 mm. long, 1-nerved, keeled, lanceolate, scabrid on the keel and on the dorsal surface; upper glume 6.6-5 mm. long, lanceolate, acute, 3-nerved, scabrid on the keel and on the dorsal surface and minutely toothed on the margins near the apex. *Lemma* 5 mm. long, ovate-lanceolate, 5-nerved, very minutely scabrid, awned from the back about 1/3 the way down from the tip; awn scabrid, 6 mm. long; palea linear-oblong, narrow, 3 mm. long. *Anthers* 3, 2 mm. long, narrow. *Ovary* smooth and glabrous 1.5 mm. long.

Common on Japvo and Singkhu, NAGA HILLS, and also in the BALIPARA FRONTIER TRACT, circa 10,000 ft.

4. Deyeuxia nagarum Bor, Ind. For. Rec. (Bot.)
L. 3 (1938) 69.

A slender perennial grass; culms up to 1 m. tall, simple, terete, smooth and glabrous. *Leaves* linear, tapering to a fine point, rounded at the base, almost smooth, soft, pale green shortly and distantly pilose on the upper surface, glabrous on the lower surface, margins minutely scaberulous, up to 30 cm. long, 4 mm. broad; sheaths loose, slipping from the culm, smooth and glabrous, striate; ligules membranous, up to 2 mm. long.

Inflorescence a very lax panicle with spreading branches; branches 3-4-5-nate on a straight slender axis, filiform, flexuous, branching, almost smooth; pedicels shorter than the spikelets, dilated at the tip. *Spikelets* lanceolate, gaping, awned, 4·5-5·5 mm. long; lower glume ovate-lanceolate when flattened, almost smooth, 4·5-5·5 mm. long, scarious, aristate, 1-nerved; upper glume 5 mm. long, lanceolate, aristate, almost smooth, 3-nerved, margins scarious; lemma 3·5-4 mm. long, broadly lanceolate, 5-nerved, hyaline, tip acute, very readily dividing into 5 aristæ which are the prolongations of the nerves, smooth on the back below the middle, very minutely scaberulous with downwardly directed spines below the tip; awn 4-5 mm. long, filiform, antrorsely scabrid, inserted on the lemma one-fifth to one quarter the length of the lemma below the tip; palea lanceolate-oblong, tip acute or obtuse, 2-nerved, 2·5-3 mm. long; rhachilla 1 mm. long, naked for half its length, the upper half thickly clothed with white hairs 3 mm. long. *Anthers* 3, 1·5 mm. long, very narrow. *Styles* 2, plumose.

Found on Japvo, NAGA HILLS at about 9,500 ft.

3. AULACOLEPIS Hack.

Spikelets 1-flowered, arranged in an effuse panicle, lanceolate, laterally compressed; rhachilla articulate above the glumes and produced beyond the upper floret into a short, naked stipe. *Glumes* two, persistent on the pedicel, unequal, carinate, muticous, membranous, 1- to 3- nerved, $\frac{1}{3}$ shorter than the lemma. *Lemma* equalling the spikelet in length, chartaceous-membranous to coriaceous, lanceolate, muticous,

with an entire, acute, hyaline tip, keeled on the back, 5-nerved; callus short, obtuse, glabrous or bearded; palea equal to the lemma in length, membranous, acute, entire, 2-nerved, 2-keeled, deeply sulcate between the keels. *Lodicules* 2, cuneate. *Anthers* 3, linear. *Ovary* oblong, glabrous; styles very short; stigmas plumose.

Tall slender, leafy grasses; leaves flat, flaccid; lemmas coriaceous.

Aucolepis treutleri Hack. in Fedde, Rep. Spec. Nov. III. 242. Syn. *Deyeuxia treutleri* Stapf in Hook. f. F. B. I. VII (1897) 269.

Culms geniculate at the rooting base then erect, up to 50 cm. tall, very glabrous, smooth, terete and shining, leafy to the panicle. *Leaves* linear-lanceolate, flat, soft, dark green, gradually terminating in a fine point, finely nerved, scabrous on both surfaces and on the margins, up to 25 cm. long, 1-1.5 cm. broad, sheathes minutely asperulous, rather lax, exceeding for the most part the nodes of the culms in length; ligule 2-3 mm. long, truncate.

Inflorescence an ovate-oblong panicle about 25 cm. long, 10 cm. broad, lax, patent, with 5-7-nate filiform or sub-capillary scabrid branches. *Spikelets* ovate-lanceolate 2.5-2.8 mm. long; lower glume 1.5-1.7 mm. long, 1-nerved, very scabrid; upper glume 2.2-2.4 mm. long, 1-nerved, scabrid; lemma ovate-lanceolate, 2.5-2.8 mm. long, rather obtuse, scabrid above, callus glabrous; palea obtuse, scaberulous above. *Anthers* 3, 1.3 mm. long. *Rachilla* produced, glabrous, about 1 mm. long, attenuate at the top, rarely supporting a rudimentary glume.

Collected on Piri, 10,000 ft., AKA HILLS.

4. CALAMAGROSTIS Adans.

Spikelets lanceolate-acuminate, crowded on the numerous scaberulous or smooth branchlets of an effuse or contracted panicle. *Glumes* lanceolate-acuminate, unequal, the lower shorter 1-nerved, the upper longer 3-nerved, scaberulous on the keels, not jointed on the pedicels; rhachilla jointed below the lemmas and not produced (or very occasionally produced); callus long or short bearded. *Lemmas* hyaline

much shorter than the glumes, 5-nerved, often cleft at the apex, glabrous or hairy on the dorsal surface; palea shorter than the lemma, hyaline. *Stamens* 3, anthers long or short. *Lodicules* 2. *Grain* free within the lemma and palea.

Stout or slender grasses, often tall with long flat leaves. *Inflorescence* an effuse or contracted panicle, often silky, shining.

Key to the species of *Calamagrostis*.

Callus hairs longer than the lemma	.. 1. <i>C. emodensis</i> .
Callus hairs shorter than the lemma	.. 2. <i>C. griffithiana</i> .

1. *Calamagrostis emodensis* Griseb. in Goett. Nachr. (1868) 80.

Culms stout, erect from a creeping geniculate base, up to 1.5 m. tall; bases of the culms clothed with the remains of old sheaths. *Leaf-blades* 30-40 cm. long up to 8 mm. wide, flat, flaccid or thinly coriaceous, scabrous on both surfaces, long, tapering to a fine point, many-nerved, glabrous; sheaths scaberulous, striate, rather loose; ligule oblong, membranous.

Inflorescence an effuse, soft, shining panicle up to 20 cm. long; branches whorled, naked for half their length; branches and branchlets capillary minutely scaberulous or smooth. *Spikelets* numerous crowded. *Lower glume* 6 mm. long, lanceolate, long acuminate, 1-nerved, scariosus on the margins, scabrid on the keel; *upper glume* 6.5-7 mm. long, lanceolate, long acuminate, scabrid on the keel, scariosus on the margins. *Lemmas* glabrous on the dorsal surface, 2.5 mm. long, overtopped by the long (4 mm.) callus hairs, awned from below the tip, faintly 5-nerved; awn up to 7 mm. long; palea 2 mm. long, lanceolate, hyaline. *Grain* spindle-shaped, 1 mm. long.

Japvo, NAGA HILLS, 9,900 ft.

2. *Calamagrostis griffithiana* Hook f. in F. B. I. VII (1897) 263.

Culms stout, often tufted, erect, smooth, terete, glabrous and shining, up to 1 m. tall. *Leaf-blades* linear-lanceolate, sub-coriaceous, 15-25 cm. long by 3-4 mm. broad, smooth and glabrous on both surfaces; sheaths rather loose, striate,

smooth and glabrous or minutely scaberulous; ligule truncate. scaberulous, 2-3 mm. long.

Panicle long, narrow, 6-20 cm. long, decomound. branches and branchlets sub-erect, capillary, smooth or scaberulous, glabrous; branches 5-10 cm. long, 2-5-nate, naked for half their length, thin, with crowded branchlets and shortly pedicelled green or purplish spikelets. *Spikelets* 3.25 mm. long or just under; lower and upper glumes subequal, lanceolate, acute, 3.25 mm. long, 1-nerved, scabrid on the keel; lemma ovate truncate, 4-5-nerved, hairy all over on the back, the four nerves being continued as 4 short bristles, callus hairs very short, awn sub-basal to median, exserted, 5-6 mm. long; palea nearly as long as the lemma, hyaline, obtuse. 2-nerved; stamens 3, anthers 1.25 mm. long, linear.

Very common on the hills about Shillong, Mawphlang, and elsewhere, 5-6,000 ft.

5. MUEHLENBERGIA Schreb.

Spikelets 1-flowered, the rhachilla disarticulating above the glumes; glumes shorter than the lemma; lemma firm-membranaceous, 3-nerved, with a short callus, pilose, apex acute, awned from the tip, or from between very short lobes. the awn straight or flexuous. *Palea* as long as the lemma, 2-nerved, almost uniting in the tip. *Lodicules* 2, very minute. *Anthers* short or long. *Styles* free. *Stigmas* short. *Caryopsis* cylindric, free in the glume and palea.

Annual or perennial, very slender grasses. *Leaves* narrow flat.

Muehlenbergia huegelii Trin. in Mem. Acad. Peters. ser. 6, VI. II. (1845) 293. Syn. *M. viridissima* Nees ex Steud. Syn. Pl. Glum. (1854) 178.

A perennial grass. *Culms* rather weak and often scrambling over other vegetation, up to 1.6 m. long. *Leaf-blades* flat, 8-15 cm. long, 4-8 mm. broad, scabrid, linear-acuminate, sheaths loose; ligule a membranous ring, lacerate.

Panicle elongate, much fastigiate branched, up to 20 cm. long, flexuous, interrupted, branches and pedicels slender. *Spikelets* seated upon scabrid pedicels, up to 2 mm. long.

Lower glume 1 mm. long, strongly 1-nerved, ovate-lanceolate, scabrid on the keel; *upper* glume 1.5 mm. long, 1-nerved, scabrid on the keel. *Lemma* ovate-lanceolate, 2.2-2.5 mm. long, hairy below the middle, 3-nerved, the centre nerve produced into a long, slender, flexuous awn, 2 cm. long; *palea* as long as the lemma, ovate-lanceolate, 2-nerved, 2-keeled, hairy below the middle.

KHASI HILLS & NAGA HILLS. A forest grass.

6. PHLEUM Linn.

Spikelets 1-flowered, laterally compressed, imbricate in cylindric or oblong spiciform panicles, disarticulating above the glumes; pedicels very short. *Glumes* equal, membranous, keeled, abruptly awned or mucronate or gradually acute. *Lemma* shorter than the glumes, hyaline, broadly truncate, 3-5-nerved; *palea* narrow nearly as long as the lemma.

Annual or perennial grasses with erect culms, flat blades and dense cylindric panicles.

Phleum pratense Linn. Sp. Pl. (1753) 59.

A tufted perennial; culms erect, 40-70 cm. tall; nodes short, often violet coloured; smooth and glabrous. *Leaves* linear, erect, tapering to a fine point, midrib prominent, smooth and glabrous, up to 20 cm. long, 4-8 mm. wide, auricles absent; sheath terete, smooth and glabrous, close fitting; ligule white, membranous, erose, up to 4 mm. long.

Inflorescence a cylindrical false spike, 3-15 cm. long, usually about 7 cm. The spikelets are densely crowded, seated upon very short, erect, scaberulous branches; 1-flowered, rhachilla disarticulating above the glumes. *Lower glume* 2.5-3.5 mm. long, oblong, rounded at the top, keeled, villous, central nerve produced into an awn-like point, 1.1-1.5 mm. long; keel ciliate with stiff hairs. *Upper glume* similar in shape, texture and nervation. *Lemma* hyaline, 1.5-1.75 mm. long, broadly ovate, truncate, toothed, 3-5-nerved, central nerve produced into a short awn or not; *palea* narrow, hyaline, 1.25-1.5 mm. long. *Lodicules* 2. *Stamens* 3, anthers

1 mm. long. *Ovary* glabrous, styles long. *Caryopsis* spherical-ovoid in shape, surface finely reticulate, separating easily from lemma and palea.

Introduced into Shillong and escaped.

7. ALOPECURUS Linn.

Spikelets narrowly to broadly oblong or elliptic-oblong, strongly laterally compressed, usually awned, falling entire, closely to densely imbricate, shortly pedicelled in solitary spiciform panicles or racemes; rhachilla disarticulating below the glumes and not between the glumes and the floret, not produced beyond the floret. *Floret* 1, hermaphrodite, enclosed by the glumes or with the apex slightly exserted. *Glumes* deciduous, equal or sub-equal, similar, lanceolate to oblong in profile, acute or obtuse, awnless, cuspidate and shortly awned, strongly compressed and keeled, usually connate by their margins in the lower part or up to the middle. 3-nerved, membranous to herbaceous, scabrid or ciliate on the keels, with keels narrowly winged or wingless.

Lemma as long as the glume or very slightly longer, more or less oblong or ovate-oblong, obtuse, apiculate or truncate, hyaline and membranous, 3-5-nerved, with the nerves more prominent upwards, glabrous or pubescent at the apex, usually connate along its margins towards the base, awned from the back below the middle, rarely from above the middle; awn exserted or enclosed; palea usually appressed, rarely present and then narrow, 1-nerved, hyaline, up to nearly as long as the lemma. *Lodicules* suppressed. *Stamens* 2-3; anthers linear to oblong-elliptic. *Ovary* glabrous; styles usually more or less connate; stigmas elongate shortly plumose, terminally exserted. *Grain* laterally compressed, free between the lemma and palea, oblong or elliptic in outline; hilum subbasal; embryo $\frac{1}{2}$ - $\frac{1}{4}$ the length of the grain.

Annuals or perennials, loosely to densely tufted, or with geniculately ascending and spreading culms, ligules membranous, glabrous; blades linear, usually flat, inflorescences dense, cylindric to oblong, ovate or sub-globose, rather soft; pedicels with thickened discoid tips; spikelets protogynous.

Key to the species of *Alopecurus*.

- Spikelets 5 mm. long. 1. *A. myosuroides*.
 Spikelets 2 mm. long. 2. *A. geniculatus*.

1. Alopecurus myosuroides Huds. Flor. Angl. (1762) 23. Syn. *A. agrestis* Linn. Sp. Pl. Ed. II. 39.

Annual, 25-90 cm. high. *Culms* loosely tufted or solitary, erect or geniculate in the lower part, slender to somewhat stout, simple or branched from the lower nodes, 2-4-noded, glabrous, smooth or finely scaberulous towards the nodes and inflorescence. *Leaves* glabrous; sheaths finally shorter than the internodes, striate, rather loose, smooth or finely scaberulous, the uppermost sometimes slightly inflated; ligule truncate, 1 mm.-2·5 mm. long, membranous, asperulous on the back; blade linear, tapering to a slender acute or obtuse tip, 2·5-22·5 cm. long, 1·5-8 mm. wide, flat, scaberulous on the nerves or rarely smooth.

Inflorescence dense cylindrical, tapering towards the apex, erect or slightly nodding, 2·5-10 cm. long, 3-8 mm. in diameter, green or purplish; rhachilla ribbed, smooth or slightly scabrid; pedicels 6-3 mm. long, rigid. *Spikelets* oblong to elliptic-oblong, closely imbricate, 6 mm. long. *Glumes* lanceolate-oblong and acute in profile, connate for $\frac{1}{2}$ - $\frac{1}{3}$ their length, stiffly ciliolate on the keels below the middle and scabrid above, glabrous on the sides or sparingly pubescent. *Lemma* oblong, obtuse, membranous with herbaceous tip, glabrous smooth, 5-nerved, awned from near the base, awn up to 11 mm. long, antrorsely scabrid, geniculate or curved; palea absent; anthers 2-3 mm. long. *Grain* laterally compressed, free.

NAGA HILLS, in irrigated rice terraces. 4-6,000 ft. KHASI HILLS, 3,000 ft.

2. Alopecurus geniculatus Linn. Sp. Pl. (1753) 60.

An annual or sub-perennial grass. *Culms* erect or geniculate at the base, rooting at the nodes, 20-60 cm. tall, stout or slender. *Leaf-blades* lanceolate, abruptly contracted or rounded at the base, up to 6 cm. long, 3-4 mm. broad, glabrous and smooth or nearly so; upper sheaths more or less

inflated, smooth and glabrous, striate, ligule 3-4 mm. long, membranous, erose.

Inflorescence a cylindric or oblong, spiciform panicle. 2·5-7·5 cm. long, 6-8 mm. in diameter, greenish yellow in colour. *Spikelets* strongly compressed, 2·75 mm. long. *Glumes* equal, connate at or above the base, sub-acute or obtuse, 2·75 mm. long, hyaline, ciliate; lemma truncate 2·5 mm. long, awned from the base, tip truncate, sub-erose; awn up to 4·5 mm. long. *Stamens* 2 or 3, linear, orange.

Collected by Griffith in Assam. It has not been collected since his time.

8. GARNOTIA Brongn.

Spikelets solitary or geminate, narrowly lanceolate, articulate on their pedicels. *Lower* and upper glumes sub-equal, 3-nerved, acuminate, or upper obtuse, equaling or longer than the lemma, awned or not. *Lemma* hermaphrodite articulate at the base, 1-3-nerved, very narrow, terete, acuminate or notched at the tip, terminally awned, rarely awnless or 3-awned, margins of the palea dilating at the base into auricles which clasp the linear or oblong grain.

Erect perennial or annual grasses with flat or convolute leaves.

Key to the species of *Garnotia*.

A tall plant; spikelets 4 mm. long, green; leaves narrow complicate.

.. .. 1. *G. stricta*.

A dwarf plant; spikelets 4·5 mm. long, purplish; leaves broad, flat.

.. .. 2. *G. emodi*.

1. *Garnotia stricta* Brongn. in Duperr. Voy. Bot. (1829) 133. t. 21.

Annual or perennial (?). *Culms* up to 1 m. tall, erect from a geniculate base, glabrous, smooth, striate, often tufted, nodes often bearded. *Leaf-blades* 15-25 cm. long, up to 1 cm. broad, linear-lanceolate, flat or margins involute, scabrid, when young with longish white hairs on the surface; sheaths glabrous and smooth outside, margins hirsute, sometimes densely, hairy on the collar and at the throat; ligule a membranous ring topped with short crowded cilia.

Inflorescence a strict or flaccid panicle. *Spikelets* seated upon short scabrid pedicels at the ends of capillary and seabrid branches. *Rhachilla* disarticulating below the glumes and the spikelet falls entire; there is a tuft of hair just below the glumes and above the joint. *Rhachis* triangular in section, the two lateral angles scabrid; lower glume membranous, 3-nerved, rounded on the back, lanceolate with or without an awl, nerves scabrid on the back, 4 mm. long; upper glume of similar texture and nervation, tip obtuse, aristulate or not. *Lemma* lanceolate, 3 mm. long, somewhat thickly membranous, tapering to a scabrid awn which may be 11 mm. long. (In Hook. f. F.B.I. the lemma is described as 1-nerved, 2 other exceedingly fine nerves may sometimes be made out, they are very obscure). *Palea* nearly as long as the lemma with margins clasping the grain, hyaline. *Grain* terete, 2 mm. long, embryo 1/3 the length of grain. *Stamens* 3, anthers 1.5 mm. long.

Hook. f. in F.B.I. VII. 243, mentions two varieties var. *khasiana* a stout form and var. *breviaristata*; with regard to the latter the possession of awns by the glumes is a very variable character and spikelets in the same plant may differ in this respect. It is probably not a good variety.

A specimen of this plant collected on Pulebadze, Naga Hills, is only 9 cm. tall with leaves 2.3 cm. long, spikelets normal but with awls as long as the spikelets.

Very common and variable plant in the hills, 4,700 ft.

2. *Garnotia emodi* (*Arn. et Nees*) Janowsky in Fedde, Rep. Spec. Nov. XVII (1921) 86. Syn. *G. poly-pogonoides* Munro ex Oliver in Hook. Ic. Pl. t. 1481.

A small tufted, slender grass. *Culms* up to 20 cm. tall, *Leaf-blades* flat, slightly rounded at the base, broadly lanceolate, tapering to a sharp point, 10-15 cm. long, by 3-6 mm. broad with sparsely scattered, short, white hairs from bulbous bases; sheaths smooth longer than the internodes, with often a few short, white hairs from bulbous bases; ligule a short membranous collar.

Inflorescence a contracted, erect, panicle purplish in colour; branches and branchlets angled, minutely scabrous; pedicels slightly dilated at the apex. *Spikelets*

4.5 mm. long, bearded at the base. *Lower glume* 4 mm. long, lanceolate, purplish, 3-nerved, awned from the tip: awn up to 1 cm. long or shorter; *upper glume* 4.5 mm. long, more broadly lanceolate than the lower, awned from the tip with an awn up to 2 cm. long; *lemma* stipitate, 4.5 mm. long, hyaline, 2-lobed at the top with the lobes shortly aristate, awned in the sinus: central awn up to 3 cm. long, very slender, flexuous: *palea* 3.5 mm. long, obtuse, lanceolate, hyaline. *Stamens* 2 (3?); anthers linear, 1.5 mm. long. *Ovary* minute; stigmas plumose.

BALIPARA FRONTIER TRACT. 10,000 ft. (Kingdon-Ward).

9. POLYPOGON Desf.

Spikelets 1-flowered, in dense spike-like, often lobed panicles, disarticulating from the pedicels; rhachilla disarticulating below the lemma, not produced; flowers hermaphrodite. *Glumes* 2, sub-equal, awned from the entire or 2-lobed tips. *Lemma* shorter than the glumes, very thin to hyaline, glabrous, truncate, faintly or obscurely 5-nerved, the lateral nerves shortly excurrent or evanescent with the hyaline tips; awn very fine, usually deciduous, subterminal, sometimes reduced to a mucro or absent. *Palea* 2-keeled, slightly shorter than the lemma. *Lodicules* 2, delicate. *Stamens* 3. *Ovary* glabrous; style distinct, very short; stigmas laterally exserted, loosely plumose. *Grain* oblong, subterete or slightly grooved, enclosed by the unaltered lemma and palea.

Key to the species of *Polypogon*.

- | | |
|----------------------------------------------------------------------------|------------------------------|
| Awns 5.9-7.5 mm. long, 2-3 times the length
of the glumes. | 1. <i>P. monspeliensis</i> . |
| Awns 1.25-3.75 mm. long, as long as or shorter
than the glumes. | 2. <i>P. fugax</i> . |

1. *Polypogon monspeliensis* Desf. Fl. Atlant. i. 67.

An annual tufted grass, stout or slender, from a geniculate base, 15-60 cm. high. *Leaves* flat, linear, gradually tapering to a point, scabrid, glabrous; sheath striate, scaberrulous, inflated; ligules up to 6 mm. long, membranous, lacerate, ciliolate.

Panicle spike-like, cylindric, sometimes lobed or interrupted below, 3·5-12 cm. long, light green or straw-coloured, branches with numerous branchlets from the base, scaberulous; lateral pedicels extremely short, disarticulating near the base; spikelets 2·2-5 mm. long; glumes sub-equal, linear or oblanceolate-oblong, shortly 2-lobed or emarginate, scaberulous, ciliate or ciliolate, awn up to 8 mm. long; lemma 1·25 mm. long, broadly ovate-truncate, minutely 2-4 mucronulate, nerves very obscure; awn as long as the lemma or shorter or absent; palea 2-toothed or 2-mucronulate, almost as long as the lemma; stamens 3, anthers about ·5 mm. long, lodicules 2. *Caryopsis* about 1·5 mm. long, subterete, grooved.

BALIPARA FRONTIER TRACT, 9,000 ft.

2. *Polypogon fugax* Nees ex Steud. Syn. Pl. Glum. I. (1854) 184. Syn. *P. higagaweri* Steud. Syn. Pl. Glum. I (1854) 422.

Annual. *Culms* erect from a geniculate base. *Leaves* linear, flat, very scabrid, 6-10 cm. long, 3-5 mm. broad tapering to a point; sheaths somewhat inflated, smooth and glabrous, striate; ligule membranous, lacerate, up to 6 mm. long.

Inflorescence a spike-like panicle. *Branches* and branchlets scabrous; branchlets crowded. *Spikelets* very small, 2 mm. long, awned, seated on very short pedicels, articulated at the base, gaping. *Glumes* subequal, ovate-oblong, 2 mm. long, 1-nerved, apex 2-lobed, the nerve being continued out between the lobes into an antorseously scabrid awn up to 3·5 mm. long, or shorter, scabrid on the keels and scaberulous on the dorsal surface, margins ciliolate. *Lemma* nearly 1·5 mm. long, ovate, truncate, very delicate, obscurely 5-nerved, the nerves ending in minute teeth which crown the truncate apex; an antorseously scabrid awn, 1·5 mm. long, issues from the dorsal surface; palea narrowly oblong, 2-toothed or 2-mucronulate, 1 mm. long, hyaline. *Achenes* ·5 mm. long. *Ovary* glabrous; styles short; stigmas plumose.

NAGA HILLS.

10. SPHÆROCARYUM Nees.

Spikelets 1-flowered, very minute, ovoid, pedicelled on the close-set, capillary branches of a pyramidal panicle, sessile in the axils of the uppermost leaf-sheath, jointed on the pedicels, rhachilla jointed at the base, not produced. *Glumes* 2, cymbiform, glabrous, hyaline. *Lemma* cymbiform, hirsute. *Palea* as long as the lemma. *Stamens* 3, anthers linear. *Lodicules* 2. *Ovary* narrowly ellipsoid; styles short free. *Grain* ovoid free, pericarp adherent to the seed.

A dwarf annual; stem creeping and ascending, leafy throughout. *Leaves* ovate cordate, acute, amplexicaul.

Sphærocaryum malaccense (*Trin.*) Pilger in Fedde, Rep. Spec. Nov. XLV (1938) 1. *Syn.* *S. pulchellum* (Roth) Merr. in Phil. Journ. Soc. Bot. XI (1916) 52; *S. elegans* Nees ex Steud. Nom. Ed. II. 2. 620.

An annual. *Culms* very slender from a creeping or geniculate base, leafy to the top. *Leaves* all alike in size and form, ovate, cordate, amplexicaul, acute or acuminate, ciliate, serrulate, sub-coriaceous, ecostate, nerves very close-set; sheaths shorter than the internodes, usually sparsely hirsute but very much so at the nodes; ligule a ring of short, white, stiff hairs.

The panicle is up to 4 cm. long by 3 mm. broad, solitary and terminal in the axil of the uppermost leaf-sheath, or very occasionally one or two others lower down on the stem also in the axils of leaves; branches many, opposite or alternate, they and the rhachis smooth and glabrous. *Spikelets* minute, 1·1-·5 mm. long, ovoid to globose. *Lower glume*, cymbiform, hyaline, tip obtuse, 1 mm. long, upper glume similar in shape but 1-nerved. *Lemma* broadly ovate, convolute, 1-nerved, very hairy on the back, barely 1 mm. long; palea almost as long as the lemma, hirsute. *Stamens* 3, anthers ·5 mm. long linear. *Lodicules* 2, minute. *Ovary* narrowly ellipsoid, glabrous. *Style* minute, stigmas shortly branched.

Very common in marshy places in the hills, 4,600 ft.

II. STIPEÆ.

Annual or perennial herbs, frequently with tough, rigid culms; leaf-blades narrow; spikelets all alike, hermaphrodite, 1-flowered, arranged in open or contracted panicles, very rarely solitary; rhachilla disarticulating above the glumes, not produced beyond the floret; glumes mostly persistent, one or both usually as long as or longer than the floret; lemma usually terete with convolute or involute margins, rarely dorsally compressed, becoming rigid and indurated at maturity, 3- to 7-nerved with the nerves close together at the apex, often with a bearded, basal callus, awned from the entire or minutely 2-lobed tip, with the awn simple or divided into three branches, rarely awnless; lodicules 3 or 2; stamens 3; caryopsis tightly embraced by the lemma and palea.

Key to the genera of *Stipeæ*.

Awn tripartite.	..	..	..	1. <i>Aristida</i> .
Awn simple.	..	..	..	2. <i>Stipa</i> .

1. ARISTIDA Linn.

Spikelets 1-flowered, arranged in panicles; rhachilla disarticulating above the glumes, not produced. *Glumes* usually persistent, narrow, 1-3-nerved, muticous or mucronate, occasionally shortly awned. *Lemma* convolute, cylindric, faintly 3-nerved, 2-fid or entire at the tip; villous, shortly bearded, usually pungent; awn nearly always 3-partite from the base or above the base, continuous with the lemma or jointed to it, foot straight or twisted, bristles plumose, or the lateral or all naked; *palea* small, oblong, 2-nerved or nerveless. *Lodicules* 2. *Stamens* 3. *Ovary* glabrous; styles distinct, short; stigmas plumose, laterally exserted. Grain slender cylindric or oblong-cylindric, terete, sometimes grooved, tightly embraced by the lemma; hilum linear, almost as long as the grain; embryo short or long.

Annual, or more often perennial, tufted grasses with wiry culms and narrow, usually convolute leaves; ligule a fringe of hairs; panicle spike-like or effuse.

Aristida adscensionis Linn. Sp. Pl. (1753) 82.

An annual or perennial, densely tufted grass. *Culms* 25-60 cm. long, very slender, simple or branched, sometimes geniculate at the base. *Leaves* 6-25 cm. long, 1-2 mm. broad, convolute, filiform, smooth or scaberulous, sheaths smooth with rounded auricles; ligule a ridge of soft hairs.

Inflorescence a linear spike-like panicle, usually interrupted, sometimes oblong, more or less lax, rigid or flaccid; branches single or 2-nate, unequally branched from the base, or simple to the middle, erect or nodding or flexuous, filiform, scabrid; lateral pedicels short. Spikelets 6-8 mm. long, one-flowered, often purplish. *Glumes* linear to linear-lanceolate, acute or sub-obtuse, 1-nerved; the lower 4-5.6 mm. long, the upper 7.5 mm. long (or longer up to 8 mm.), sometimes mucronate. *Floret* one, hermaphrodite; lemma linear, laterally compressed, as long as the upper glume or slightly longer, rarely shorter, scabrid along the keel and the outer nerves, otherwise smooth, or scabrid below the straight tip; callus .5 mm. long; awn trifid; central branch up to 15 mm. long or even longer, lateral branches diverging and somewhat shorter than the central, continuous with the lemma; palea obtuse, less than 1 mm. long. *Lodicules* 2, similar to palea, 2-3-nerved. *Anthers* up to 2 mm. long. *Caryopsis* as long as the lemma.

River beds in GOALPARA.

2. STIPA Linn.

Spikelets narrow, 1-flowered, arranged in panicles; rachilla disarticulating above the glumes, not produced. *Glumes* usually persistent, 1-3-nerved, muticous or mucronate, *Lemma* convolute, cylindric or oblong cylindric, 5-7-(rarely 3-) nerved, rather rigid, tip gradually tapering or minutely 2-lobed; callus more or less bearded, usually pungent; awn simple, continuous with or jointed on the lemma, bent or geniculate, twisted below, plumose or naked above the knee; palea

2-keeled or 2-nerved, almost as long as the lemma or much shorter. *Lodicules* usually 3. *Stamens* 3. *Ovary* glabrous; styles distinct; stigmas plumose. *Grain* cylindric, tightly embraced by the hardened lemma and palea.

Perennial, rarely annual, grasses with convolute, rarely flat, leaves; ligules membranous; panicle spike-like to effuse.

Stipa roylei (Nees) Mez in Fedde, Rep. Spec. Nov. XXVII (1921) 207. Syn. *S. orthoraphium* Steud. Syn. *Pl. Glum.* (1854) 131.

A perennial grass with densely tufted stems. *Culms* slender, up to 60 cm. tall, smooth and glabrous. *Leaf-blades* 15-30 cm. long, flat or convolute, 2-4 mm. broad, glabrous, somewhat scabrid; sheaths auricled, smooth and glabrous, except on the margins, which are hirsute and scabrid; ligule a membranous lacerate ring, ciliate.

Inflorescence a narrow panicle 15-25 cm. long; branches few, short, erect, smooth and glabrous; pedicels short, bearing 1-flowered, terete, erect spikelets; rhachilla not produced, disarticulating above the glumes and below the floret. *Lower glume* 9 mm. long, membranous 3-nerved, oblong, tip obtuse; upper glume similar in shape and texture, 10 mm. long. *Lemma* 10 mm. long, indurated, subulate; callus obconic, bearded, short; awn up to 2.5 cm. long, stout, not twisted, jointed on the lemma, with 2 or more deflexed spinules towards the base; palea about 7 mm. long, hyaline, margins involute. *Lodicules* 2, large. *Stamens* 3; anthers long. *Ovary* small, glabrous.

Japvo and Saramethi. NAGA HILLS, 9-10,000 ft.

12. ZOYSIEÆ.

Spikelets hermaphrodite or some hermaphrodite and others male, 1-flowered, falling entire, either singly or in clusters of 2 to 5, in slender spiciform panicles or racemes; rhachilla usually not produced beyond the floret; glumes equal or the lower much smaller or suppressed, awnless or with a straight awn from the tip, the upper or both often indurated; lemma shorter than the upper glume, hyaline or delicately membranous, 1- to 3-nerved, usually awnless; lodicules 2 or 0; stamens 2 or 3.

Low annual or perennial herbs; leaf-blades short and often rigid.

Key to the genera of *Zoysieæ*.

Glumes awned : spikelets solitary. 1. *Perotis*.
Glumes awnless : spikelets in clusters of 2-5. 2. *Tragus*.

1. PEROTIS Ait.

Spikelets very small, narrow, sessile or sub-sessile on the continuous axis of a spike or a lax spike-like raceme, jointed on and falling entire from the axis or the rudimentary pedicels. rhachilla not continued beyond the floret. *Floret* 1, hermaphrodite, much shorter than the glumes. *Glumes* equal, linear or linear-lanceolate, rigidly membranous, 1-nerved, passing into capillary awns. *Lemma* lanceolate, acute, delicately hyaline, 1-nerved. *Palea* very minute, hyaline, nerveless. *Lodicules* 2, broadly cuneate. *Stamens* 3. *Styles* distinct, short; stigmas plumose, laterally exserted. *Caryopsis* cylindric, slender, exserted from the unchanged floret and enclosed with it in the glumes; embryo 1/3 the length of the caryopsis; hilum punctiform, basal.

Annuals or perennials; culms leafy; blades usually broad, rigid and ciliate; ligules hyaline; spikes or pseudo-spikes slender, villous from the long capillary awns.

Tropics of the Old World and the sub-tropics of Australia.

Perotis indica (*Linn.*) *O. Kuntze*, Rev. Gen. Pl. (1891) 787. Syn. *P. latifolia* Ait. Hort. Kew. I (1789) 85.

A tufted wiry annual or sub-perennial grass. *Culms* up to 45 cm. tall erect from a geniculate base, smooth and glabrous. *Leaf-blades* flat, ovate or lanceolate, base cordate, tapering to an acute tip, surfaces smooth and glabrous, margins spinulose, 1·2-·5 cm. long, 4 mm. to 1 cm. broad; sheaths short, loose, striate, smooth and glabrous, margins scarious; ligule a very minute, membranous ridge; upper margin erose or ciliate.

Inflorescence a spike-like terminal raceme consisting of numerous small spikelets seated upon very short pedicels on a central, simple, scabrid rhachis which is 2·5-20 cm. long. *Spikelets* 2·5-4 mm. long; callus conical. *Glumes* subequal, 2·5-4 mm. long, linear, narrow, scabrid or hispid, tapering into a scabrid, purple awn up to 1·5 cm. long. *Lemma* 1 mm. long, hyaline, narrowly lanceolate; palea narrow, about as long as the lemma, hyaline. *Stamens* 3. *Styles* 2. *Lodicules* 2. *Grain* linear, terete, nearly as long as the glumes and free within them.

Found in the plains portion of the GARO HILLS and doubtless elsewhere in the province. In other parts of INDIA it ascends to 6,000 ft. This grass is a good fodder and is relished at all stages by stock.

2. TRAGUS Haller.

Spikelets sessile, in deciduous clusters of 2-4, on the filiform, continuous axis of a cylindric, spike-like panicle; rhachilla tough, not continued beyond the floret. *Floret* 1, hermaphrodite, somewhat shorter than the upper glume. *Glumes* very dissimilar, the lower facing the rhachis, minute, hyaline, or suppressed, upper 5-ribbed or 5-nerved, membranous between the hispid or spine-hooked ribs and nerves, exceeding the lemma. *Lemma* lanceolate to lanceolate-oblong, membranous, 3-nerved; palea as long as the lemma, 2-nerved. *Lodicules* 2, broad, cuneate, fleshy. *Stamens* 3. *Style* distinct, very slender; stigmas narrow, plumose, laterally exserted. *Caryopsis* enclosed by the lemma and palea, oblong to ellip-

soid, slightly compressed from the back; embryo 1/3 length of the caryopsis; hilum punctiform, basal.

Annuals or perennials; culms erect, ascending or decumbent; blades linear, rather rigid, with cartilaginous, spinulosely-ciliate margins; ligules reduced to a delicate rim; panicles cylindric, slender; all the spikelets of a cluster fertile, or often one more or less reduced.

Tragus biflorus Schult. Mant. II (1767) 205. Syn. *T. racemosus* Scop. Introd. His. Nat. (1777) 73.

An annual or perennial grass. *Culms* short, rigid, decumbent, spreading or erect, leafy almost to the top, 5-20 cm. tall. *Leaf-blades* flat, lanceolate, narrow, base subcordate, glabrous, margins distantly spinulose 6-5 cm. long, 3-4 mm. wide; sheaths long, the uppermost almost like a spathe, loose, margins scarious and minutely ciliate; ligule a dense ridge of stiff hairs.

Inflorescence a spike-like raceme, consisting of a scabrid central axis upon which are packed sessile spikelets 3·2 mm. long, in groups and deciduous clusters, usually of 2 spikelets facing each other, seldom 3, and very rarely 4 or 5, not obscurely articulated on a short peduncle, which is itself articulated on the rhachis, 1-flowered. *Racemes* 1·5-7 cm. long. *Lower glume* usually suppressed, if present, very minute and hyaline; upper glume narrowly lanceolate, 3·5 mm. long, acuminate, embracing the lemma, 5-nerved, these being present as ribs on the dorsal surface and bear hooked spines. *Lemma* ovate-lanceolate, just over 2 mm. long, puberulous, embracing a narrowly oblong palea and a bisexual flower. *Stamens* 3. *Styles* 2. *Lodicules* 2. *Grain* linear, oblong, free within the lemma and palea.

A xerophytic species found in GOALPARA.

13. PHALARIDEÆ.

Annual or perennial herbs; leaf-blades narrow; spikelets alike, hermaphrodite, mostly strongly laterally compressed, 3-flowered with the lower 2 flowers male or barren and terminal floret hermaphrodite, arranged in open or contracted sometimes spike-like panicles; rhachilla disarticulating above the glumes and not between the florets, not or rarely produced beyond the upper floret; glumes persistent, equal and as long as the spikelet, or the lower or both shorter, membranous to chartaceous; lower two lemmas longer than the third or smaller, in some cases reduced to minute scales, awnless or awned from the back or tip; terminal lemma awnless; lodicules 2 or 0; stamens 2 to 6.

Key to the genera of Phalarideæ.

Spikelets sub-terete.	..	1. Anthoxanthum.
Spikelets more or less flattened :—		
Lower lemmas scale-like.	..	2. Phalaris.
Lower lemmas well developed.	..	3. Hierochloe.

1. ANTHOXANTHUM Linn.

Spikelets oblong to narrow-lanceolate, slightly laterally compressed; rhachilla disarticulating above the upper glume not produced beyond the uppermost floret. *Florets* three, heteromorphous, the lower two male or barren, the terminal hermaphrodite. *Glumes* persistent, 1-3-nerved, keeled, acuminate; upper longer. *Lower* two lemmas equal and very similar, oblong, emarginate, membranous, strongly laterally compressed, 5-7-nerved, keeled, hairy, awned; awn of the lower lemma short from one-third to one-half way below the tip; of the upper longer, knee'd, from near the base, rarely from the middle; terminal lemma much shorter than the lower two, broadly elliptic, very thin, delicately 7-1-nerved. *Palea* of the lower two florets, if present, 2-keeled, of the terminal 1-nerved. *Lodicules* 0. *Stamens* three in the male, two in the hermaphrodite florets. *Styles* distinct, long; stigmas long,

exserted from the top of the spikelet, plumose. *Grain* ovoid, slightly laterally compressed; hilum punctiform; embryo quarter the length of the grain.

Key to the species of *Anthoxanthum*.

Perennial.	..	..	..	1. <i>A. odoratum</i> .
Annual.	..	..	..	2. <i>A. aristatum</i> .

1. *Anthoxanthum odoratum* Linn. Sp. Pl. (1753)

28.

A perennial grass; stems tufted, erect, slender, 30-60 cm. tall; roots shallow; sheaths slightly keeled, somewhat striate, sparsely hairy or glabrous; blades lanceolate, thin, flat, 2-6 cm. long, 3-5 mm. wide, sparsely villous on both surfaces, rounded at the base; apex sub-acute; ligules truncate, membranous, hyaline, thin, up to 3 mm. long.

Inflorescence a spike-like panicle; branches short; spikelets oblong-lanceolate, acute, seated on short pubescent pedicels up to 7.5 mm. long. *Lower glume* ovate-lanceolate, acute, keeled, 1-nerved; nerve ending in a bristle; keel scabrid or ciliate. *Upper glume* 7.5 mm. long, ovate-acute, mucronate, keeled, 3-nerved. *Lowest floret* barren; lemma 2.7 mm. long, hyaline, appressed pilose with golden hairs, bifid at the top, lobes obtuse, erose; a short awn issues from the median nerve just below the top; palea absent. *Middle floret* barren; lemma 2.5 mm. long, of the same shape and texture, long awned from the base; awn 10 mm. long, twisted below, geniculate. *Upper floret* hermaphrodite; lemma broadly ovate, wrapped round the palea, shining, 2 mm. long, 1-nerved, sub-keeled: palea narrower, slightly shorter; margins incurved, obtuse, glabrous. *Styles* 2; stigmas 2, very long, issuing from the top of the spikelet. *Stamens* 2.

Introduced from EUROPE and run wild in Shillong.

2. *Anthoxanthum aristatum* Boiss. Voy. Bot. Esp. 2. (1839) 638.

Differs from *Anthoxanthum odoratum* Linn. in being an annual with lower culms, often geniculate and bushy branching; panicles looser; spikelets a little smaller.

Introduced into Shillong with grass seed from southern EUROPE and run wild.

2. PHALARIS Linn.

Spikelets laterally compressed in contracted, more or less spike-like, panicles; rhachilla disarticulating above the glumes, not or obscurely produced beyond the terminal floret. *Florets* 3; the lower 2 minute, rudimentary, the uppermost hermaphrodite, enclosed by the glumes. *Glumes* sub-equal, boat-shaped, keeled; keel often winged. *Empty lemmas* very small, subulate to lanceolate, membranous, with a callous base, or one or both reduced to a minute callous scale; fertile lemma thin, ultimately rigid, 5-nerved, awnless, ovate, acute. *Palea* almost as long as the lemma, 2-nerved, sometimes obscurely. *Lodicules* 2; hyaline. *Stamens* 3. *Styles* long, distinct; stigmas plumose, exserted from the top of the spikelet. *Grain* much compressed, ovate, free, enclosed by the lemma and palea; hilum oblong, short; embryo equalling quarter the length of the grain.

Phalaris arundinacea Linn. Sp. Pl. (1753) 55.

A perennial grass; rhizome short, praemorse, stoloniferous; stolons with firm scariosus sheathing scales; culms erect from a creeping or ascending base 60-100 cm. long, rooting at the lower nodes, simple or very sparingly branched, firm, glabrous, finely striate, 5-7- or more-noded, internodes gradually longer from the base up to 25 cm. long; sheaths glabrous, smooth, strongly striate; lower tight, longer than the internodes; upper looser, shorter; ligule scariosus, white, obtuse, 3-7.5 mm. long; blades linear to linear-lanceolate, long tapering, 15-30 cm. long by 7-20 mm. wide, rigid, glaucous, glabrous, smooth, many-nerved.

Panicle erect, sometimes nodding, contracted, lobed or spike-like, up to 20 cm. long; branches very short, adpressed to the rhachis or longer (up to 3 cm.) and more or less spreading, copiously and densely branched, glabrous, smooth or scabrid; spikelets ovate-lanceolate, 6.5-15 mm. long; glumes sub-equal, whitish-green, acute, three nerved; keel not or very obscurely winged, minutely serrulate, nerves

raised; empty lemmas sub-equal, lanceolate to subulate obscurely 1-nerved or nerveless, hairy with a callous base, 1.8 mm. long; fertile lemma scantily silky 3.7 mm. long; palea ciliate on the back; lodicules obliquely ovate-lanceolate; anthers 3.5 mm. long.

Introduced into Shillong as an ornamental grass in the form var. *picta*. Has now spread in and about Shillong and as far as 16 miles outside. The escaped grass does not show the varietal characters of var. *picta*, but has reverted to the ordinary type with green leaves.

3. HIEROCHLOE Gmelin ex R. Br.

Spikelets with one perfect terminal floret and below it two male or neuter florets; the whole plexus hermaphrodite and the two male or neuter florets all falling together owing to the disarticulation of the rhachilla above the two equal or sub-equal, 3-nerved, broad, thin, papery smooth and acute glumes; staminate or neuter lemmas about as long as the glumes, boat-shaped, hispiduous, hairy along the margins; fertile lemmas somewhat indurate about as long as the others, smooth or nearly so, awnless; rhachilla not produced above the upper floret; palea 3-nerved, rounded on the back.

Perennial erect, slender, sweet smelling grasses with small panicles of broad bronze or purple coloured spikelets.

Key to the species of *Hierochloe*.

Glumes unequal.	..	..	..	1. <i>H. gracillima</i> .
Glumes sub-equal.				
Spikelets 3 mm. long.	..	..	..	2. <i>H. khasiana</i> .
Spikelets 5 mm. long.	..	..	..	3. <i>H. clarkei</i> .

1. *Hierochloe gracillima* Hook. f. in F. B. I. VII (1897) 223.

An annual grass. *Culms* weak, up to 30 cm. tall, smooth and glabrous. *Leaf-blades* up to 10 cm. long, 1.2 mm. broad, flaccid, scabrid on the margins, with few villae at the base; sheaths long, striate, smooth and glabrous, often falling from the stem; ligule membranous, 2 mm. long, erose.

Inflorescence a contracted panicle 2.5-5 cm. long, 1 cm. broad; branches short on a minutely scabrid angled axis. *Spikelets* erect, shortly pedicelled, 5.5 mm. long. *Lower*

glume 3 mm. long, 1-nerved, margins scarious, scabrid on the keel; upper glume 5.5 mm. long, 3-nerved, scarious on the margins, scabrid on the keel, minutely mucronate. *Lowest floret* neuter; lemma 5 mm. long, sparsely hairy, shortly bifid, shortly awned in the sinus, epaleate. *Middle floret* neuter; lemma 5 mm. long, obscurely 2-toothed, awn nearly basal about 9 mm. long, recurved. *Upper floret* hermaphrodite; lemma scarious; palea 1-nerved. *Stamens* 3.

Pankim La, 9,000 ft. BALIPARA FRONTIER TRACT.

2. Hierochloe khasiana C. B. Clarke ex Hook. f.
F.B.I. VII (1897) 223.

A perennial grass. *Culms* up to 80 cm. erect from a somewhat creeping base. *Leaves* 3-6 cm. long, up to 4 mm. broad, flat, linear, tapering gradually to a point, smooth and glabrous; *sheath* loose, smooth and glabrous; ligule a membranous, erose ridge.

Inflorescence a contracted panicle 4-6 cm. long, up to 1 cm. broad. *Spikelets* strongly laterally compressed, seated on pedicels 1.5 mm. long; rhachis glabrous; pedicels sparsely hairy. *Glumes* sub-equal 3.5 mm. long, keeled, scabrid on the keel; first lemma empty, epaleate, 5-nerved, 3.5 mm. long, 2-lobed, sinus 1/3 length of glume, centre nerve continued into a very short scabrid awn which does not reach the end of glume; dorsal surface covered with short brown appressed hairs; lobes hyaline glabrous; second lemma very similar, in this case, however, the scabrid awn does exceed the end of the glume. *Upper lemma* hermaphrodite; hyaline 2.5 mm. long. *Palea* narrow truncate, about 2 mm. long.

Shillong, 4,500 ft.

3. Hierochloe clarkei Hook f. in F.B.I. VII. (1897) 223.

Perennial. *Culms* up to 1 m., nodding. *Leaves* up to 30 cm. flat, linear, tapering to a fine point, scabrous above, scattered hairs beneath, undersurface glaucous; sheath smooth and glabrous, a few hairs on the margins; ligule a lacerate membranous ring sometimes 2 mm. in depth, ciliolate.

Panicle 5-10 cm. long up to 3 cm. broad. *Spikelets* 7 mm. long; terminal flower hermaphrodite above two empty lemmas, the lowest with a palea. *Lower glume* 5 mm. long, ovate, lanceolate, 1-nerved; the nerve ending in a point. *Upper glume* very strongly 3-nerved, 6.5 mm. long, minutely and distantly toothed on the upper half of the keel; first lemma 6 mm. paleate, empty, boat-shaped, 2-lobed, centre nerve produced into a short scabrid awn; margin ciliate; dorsal surface covered with short brown hairs; palea narrow, oblong, hyaline, ending in two teeth; second lemma 5.5 mm. long, oblong, 2-lobed, split 1/3 way down the keel, a scabrid awn 9 mm. arises from low down on the dorsal surface of the lemma and not in the sinus as stated by Hooker; dorsal surface covered with short brown hairs, no palea; third lemma 3.5 mm. long, indurated, glabrous and smooth, lanceolate when flattened, convolute, seated on a 1 mm. prolongation of the hairy rhachilla.

KHASI & NAGA HILLS above 6,000 ft.

14. ORYZÆ.

Annual or perennial herbs; leaf-blades narrow or rather broad; spikelets all alike and hermaphrodite, or more or less dissimilar and unisexual, apparently falling entire, 1- (rarely 3-) flowered, with the terminal floret hermaphrodite or unisexual and the lateral if present reduced to scale-like lemmas, pedicelled in open or contracted panicles, the unisexual spikelets with the sexes borne in different panicles on the same plant or in the same panicle, the female on the upper branches or at the ends of the branches, the male below them; rhachilla disarticulating below the floret or florets; glumes very minute or confluent into an annular rim or suppressed; sterile lemmas mostly shorter than the fertile floret or more often suppressed; fertile or male lemma membranous to coriaceous, awnless or with a straight awn from the tip, 3- to 9-nerved; palea 3- to 9-nerved; stamens 6, rarely 3, 2, or 1.

Key to the genera of Oryzæ.

Spikelets hermaphrodite.

Leaf-blades linear :—

Florets 3; the two lower sterile and reduced to the lemmas; fertile lemma coriaceous. 1. *Oryza*.

Floret 1; fertile lemma chartaceous. .. 2. *Leersia*.

Leaf-blades ovate-lanceolate to linear-oblong. 3. *Hygroryza*.

Spikelets unisexual.

Very tall reed-like grass. 4. *Zizania*.

I. ORYZA Linn.

Spikelets 3-flowered, only one fertile, arranged on the branches of an elongate panicle, the upper lemma articulated above the two lower sterile lemmas. *The glumes* are represented by obscure lips or scales at the apex of the peduncle. Two lower lemmas subulate, empty. *Fertile lemma* strongly laterally compressed, as long as the spikelet, coriaceous or papyraceous, hard, dimidiate-oblong, folded and keeled,

obtuse, acute or aristate, strongly 3-5-nerved; the lateral nerves forming a thickened margin; palea of the same texture as the lemma and as long, linear, 3-nerved, keeled; with membranous margins. *Lodicules* 2, entire or 2-lobed. *Stamens* 6, with slender filaments; anthers linear. *Ovary* with 2 styles and 2 laterally exserted stigmas. *Caryopsis* enclosed in the hardened lemma and palea and sometimes adnate to them.

Tall annual or perennial grasses with long narrow leaves.

Key to the species of *Oryza*.

Ligule elongated, at length splitting; spikelets 8-12.5 mm. long, annual :—

Spikelets persistent; awned or awnless. . . . 1. *O. sativa*.

Spikelets deciduous; always awned. . . . 1a. var. *jatua*.

Ligule short, truncate; spikelets 4-6 mm. long :—

Lemma hispid, awned. . . . 2. *O. officinalis*.

Lemma smooth, awnless. . . . 3. *O. meyeriana*.

1. *Oryza sativa* Linn. Sp. Pl. (1753) 333.

An annual grass. *Culms* up to 1.5 m. tall or more in the deep water varieties, rooting at the nodes, smooth; nodes glabrous. *Leaf-blades* flat, linear-acuminate, more or less scabrid below and on the margins, 30-60 cm. long, 6-8 mm. broad; sheaths smooth, with ciliate auricles, the lower without a limb, spongy; ligules long, scarious, lanceolate, finally splitting.

Inflorescence a lax erect panicle, finally nodding, 15-30 cm. long; rachis rather robust, angled and channelled, scaberulous; pedicels angular, short, swollen at the top. *Spikelets* ovate-oblong or ovoid, erect, 8-12 mm. long, awned or not. *Lower lemmas* oblong-lanceolate, acute or subulate, entire or toothed at the top about 2 mm. long, empty. *Fertile lemma* as long as the spikelet, finely granulate, hispid-ciliate; awn short; palea acuminate, of the same texture as the lemma. *Caryopsis* oblong, angular, tightly enclosed in the lemma and palea.

Cultivated throughout the province in plains and hills.

1a. *Oryza sativa* var. *fatua* Prain in Beng. Pl. (1903) 1184.

An annual growing in water or swampy places. *Culms* up to 2 m. high, often with rootlets developing on the nodes below the water surface; stems spongy below. *Leaf-blades* flat 18-40 cm. long by 6 mm.-1 cm. broad, prominently nerved, linear, finally tapering to a point, margins very scabrid, main nerves scabrid on both surfaces; sheaths smooth, many-nerved, striate, markedly inflated at the base of the plant; ligule membranous, up to 1 cm. long, finally splitting.

Panicles effuse, at first erect, finally nodding, at first concealed within the spathe-like sheaths of the uppermost leaf. *Joints* of the panicle shortly bearded, branches and branchlets smooth or minutely scabrid; pedicels long or short, minutely scabrid. The top of the pedicels is expanded into an annular ring or into two minute scales which represent the glumes. First and second lemmas empty, similar, 1-nerved keeled, scabrid on the margin near the apex, lobed on both sides or not, about 2.5 mm. long. *Fertile lemma* with a conical callus, cymbiform very strongly compressed, coriaceous, oblong in profile, ridged on either side of the keel, markedly punctate, striate in two directions, sparsely hispid, coarsely scabrid on the keel and ridges, at the apex glandular, terminating in an awn which may be 7 cm. long or more; awn coarsely scabrid and jointed on the lemmas. *Palea* very similar to the lemma and as long or slightly longer. *Awn* sometimes purple while the spikelets are green.

Very common all over the province in wet and swampy places. The grain is edible and is eaten in times of want.

2. *Oryza officinalis* Wall. apud Prodæhl. in Mez, Bot. Archiv. I (1922) 224.

An annual or perennial grass with sub-woody roots. *Culms* tufted, erect, smooth and glabrous, with distant nodes, up to 2 m. in height. *Leaf-blades* finely acuminate from a narrow base, scaberulous on the surfaces and margins, rarely smooth, 30-60 cm. long by 1.25-3.5 cm. wide; median nerve

distinct; lateral nerves 17-19, sheaths long, ciliate in the throat, not swollen, margins smooth or ciliate; ligules very short, ciliate.

Inflorescence a spreading panicle. 12-30 cm. long : branches numerous, very long, the lower often verticillate 10-20 cm. long, very slender, hairy at the base, scaberulous; rhachis rigid, angular, grooved, scabrous; pedicels very short, slightly swollen at the tips. *Spikelets* oblong, sub-imbricate, 4-6 mm. long, aristate; lower lemmas small, entire, empty, ovate acuminate or subulate, the upper sometimes absent; fertile lemma deeply grooved, hispid-ciliate, finely reticulate, granular; granulation larger than in *O. sativa*, with an arista 2-3 times as long as the lemma, slender, flexuous, hispid; palea acuminate, of the same texture as the lemma; lodicules obovate, bipartite. *Style* divided to the middle, stigmas violet.

This grass appears under the name *O. latifolia* Desv., an American grass, in the Flor. Brit. India, VII.

Common in the plains of ASSAM.

**3. Oryza meyeriana Baill. His. Pl. XII (1894) 166.
Syn. *O. granulata* Nees et Arn. in Wight. Cat. No. 2354.**

A perennial grass. *Culms* up to 1 m., slender, leafy, smooth. *Leaf-blades* flat, narrowly lanceolate, 7 cm.-15 cm. long by 1 cm. broad, hardly scabrid on the surface, scabrid along the margins, tapering to a fine point, somewhat cordate at the base, main nerves very prominent below, somewhat glaucous in colour; sheaths rather inflated below, papery, smooth, margins scarious, with a tuft of stiff hair on the collar, just at the insertion of the leaf-blade; ligule a narrow membranous ring.

The inflorescence is a simple raceme; rhachis flexuous, smooth, spikelets 4-6 mm. long, seated on short pedicels, awnless. *The glumes* are represented by the expanded top of the pedicel which projects as two minute ledges. *Lower lemmas* empty, minute or absent altogether; when present 1 mm. long, lanceolate smooth and glabrous. *Upper lemma* 5-5.5 mm. long, glabrous, conspicuously granulate, cymbiform, awnless; apex truncate and suggestive of the articula-

tion of an awn; palea similar in shape and texture. *Stamens* 6. *Ovary* glabrous.

NOWGONG & SIBSAGAR.

2. LEERSIA Swartz.

Spikelets strongly laterally compressed, pedicelled on the branches of a slender panicle, rhachilla disarticulating above the rudimentary glumes. *Floret* one, hermaphrodite. *Glumes* reduced to a very obscure, often 2-lobed rim. *Lemma* boat-shaped, compressed and keeled, with the keels and margins rigidly ciliate, awnless, 5-nerved, becoming hardened at maturity. *Palea* as long as the lemma, narrow, keeled with the keel rigidly ciliate, 3-nerved, tightly embraced by the margins of the lemma. *Lodicules* 2. *Stamens* 6, 3 or 1. *Grain* compressed, free between the lemma and palea. Perennial aquatic grasses with narrow leaf-blades.

Leersia hexandra Sw. Prodr. Veg. Ind. Occ. (1788) 21.

An aquatic perennial grass. *Culms* forming dense masses at the margins of swamps or lakes, 60-120 cm. long, slender, smooth, striate, somewhat compressed, simple or branched; nodes hairy. *Leaf-blades* erect, flat, rigid, glaucous in colour, linear, acuminate, 7-20 cm. long, 4-10 mm. broad, scabrid on the margins; sheaths scaberulous or smooth, glabrous apart from the nodes.

Inflorescence an erect terminal panicle, slender, contracted, 5-10 cm. long, of a few branches; axis and branches flexuous; branches 2-3 cm. long, erect or spreading few-spicate; pedicels very short. *Spikelets* closely imbricate, oblong, compressed, 3-4 mm. long, concave-convex in profile. *Glumes* reduced to a rim at the apex of the pedicel. *Lemma* 3-4 mm. long, dimidiate-oblong, cartilaginous, 5-nerved, the lateral nerves forming a thick border, compressed laterally, with the keel rigidly ciliate, lateral nerves very scabrid; palea hardly shorter, dimidiate, linear-oblong, 3-nerved, grasped by the margins of the lemma, ciliate on the keels. *Lodicules* 2. *Stamens* 6. *Ovary* glabrous. *Caryopsis* glabrous, hardly enclosed by the lemma and palea.

Very common in swamps and bhils up to 4,000 ft. This grass is said to provide a good fodder.

3. HYGRORYZA Nees.

Spikelets few, lanceolate, 1-flowered, shortly pedicelled, arranged on the spreading branches of a short, broad panicle. *Glumes* absent. *Lemna* papyraceous, lanceolate, tapering into a long awn, 5-nerved, keel and nerves ciliate; palea acuminate, 3-nerved, keel scabrid. *Lodicules* 2, gibbosus. *Stamens* 6, with long, linear anthers. Styles short, free; stigmas laterally exserted. *Grain* narrowly oblong, free within the lemma and palea.

Hygroryza aristata Nees in Edinb. New Phil. Journ. XV (1833) 380.

A floating grass. *Culms* 30-60 cm. long, spongy, glabrous, flexuous, branching, leafy to the panicle, rooting below with numerous capillary rootlets. *Leaf-blades* ovate-oblong or ovate-lanceolate, firm, obtuse at the apex, rounded or cordate at the base, 2·5-8 cm. long, by 8-18 mm. broad; sheaths broad, compressed, smooth; ligule absent or membranous.

Inflorescence a triangular panicle 5-8 cm. long; branches few, spreading, short, slender, smooth; pedicels with a red annulus below the middle. *Spikelets* few in number, solitary, articulate, but tardily deciduous, narrowly lanceolate, 7-8 mm. long, 1-flowered. *Glumes* absent. *Lemna* papyraceous, lanceolate-acuminate, 5-nerved, often hairy between the nerves; nerves scaberulous, awned; awn as long as the lemma; palea similar in texture to the lemma and as long but narrower, 3-nerved, keels scabrid or ciliate. *Stamens* 6. *Caryopsis* narrowly oblong, free within the lemma and palea.

A floating grass forming mats on the surface of the water. This grass is said to be relished by cattle.

4. ZIZANIA Linn.

Spikelets unisexual, 1-flowered, disarticulating from the pedicel; glumes obsolete, represented by a small collar-like ridge; pistillate spikelet terete, angled at maturity; lemma

chartaceous, 3-nerved, tapering into a long slender awn; palea 2-nerved, closely clasped by the lemma; grain cylindric, 1-2-cm. long. *Staminate* spikelet soft; lemma 5-nerved, membranous, linear, acuminate or subulate; palea about as long as the glume, 3-nerved; stamens 6.

Tall aquatic annuals or perennials, with flat blades and large terminal panicles, the lower branches spreading or ascending, bearing pendulous staminate spikelets, the upper branches ascending, at maturity erect, bearing appressed pistillate spikelets; the staminate spikelets early, the pistillate tardily deciduous.

Zizania latifolia (*Griseb.*) *Turcz.* Bull. Soc. Nat. Mosc. (1838) 105.

An aquatic perennial with well-developed stolons and rhizomes. *Culms* erect, glabrous, very thick and spongy below, slender above. *Leaves* coriaceous, flat, linear-lanceolate, tapering to a fine point, 30-100 cm. long, 2-3 cm. broad, rough on the surfaces, thickened and scabrid on the margins; sheaths loose, glabrous, striate; ligules well-developed, ovate.

Inflorescence a narrow panicle, 30-50 cm. long with a robust axis; branches numerous, erect or the lower spreading; the lower bearing male spikelets; the upper branches carrying female spikelets seated on pedicels 3 mm. long which are much swollen at the top and shortly ciliate-dentate. *Spikelets* disarticulating from the pedicels, linear oblong, the male 8-12 mm. long, the female 15-17 mm. long, both measurements not including the awn. *Glumes* absent. Male spikelets; lemma oblong, membranous, scaberulous at the top; awn 8-10 mm. long; palea membranous about as long as the lemma; stamens 6 with short filaments and obtuse anthers. Female spikelets; lemma membranous oblong, very ciliate and scabrid at the top; awn up to 20 mm. long; palea as long as the lemma; scabrid and ciliate above; ovary with long, laterally exserted, feathery stigmas.

This grass was found by Meebold in the Logtak lake in MANIPUR where it is doubtless a valuable food plant for the immense numbers of wild fowl which migrate there in the cold weather. The thickened bases of the culms are said to be used as a vegetable.

15. THYSANOLAENEÆ.

Perennial grasses; culms usually tall, solid; leaf-blades broad, many-nerved; spikelets very small, all alike, 2-flowered with the lower floret barren and reduced to the lemma and the upper floret hermaphrodite, falling with part of the pedicel from the branches of large, much-divided panicles; rhachilla tardily disarticulating above the glumes and between the florets, produced beyond the upper floret and sometimes bearing a rudimentary floret; glumes obtuse, up to half the length of the spikelet, nerveless; lower lemma as long as the spikelet, acuminate, 1- to 3-nerved, thinly membranous; upper lemma slightly shorter than the lower, acuminate or mucronate, becoming slightly hardened, 3-nerved, margin fringed with hairs; palea shorter than the lemma; stamens 2 or 3; grain free between the lemma and palea.

Thysanolæna maxima O. Ktze. Rev. Gen. Pl. (1891) 794. Syn. *T. agrostis* Nees, in Edinb. New Phil. Jour. XVIII (1835) 180.

A perennial grass. *Culms* 1·5-3·5 m. tall, rounded, hard, glabrous. *Leaves* numerous, coriaceous, broadly lanceolate, acuminate, sub-amplexicaul, flat, glaucous below, 30-60 cm. long, 5-10 cm. broad, scabrid on the margins; sheaths tight, hard, shining and very glabrous, except towards the throat; ligules cartilaginous, very short, truncate.

Inflorescence a very large, soft panicle 30-60 cm. long, glabrous, made up of many erect to sub-erect, filiform branches, which divide and sub-divide into very numerous branchlets which are covered with innumerable, minute spikelets. *Spikelets* 2-flowered, ovoid-lanceolate, acuminate, pedicellate, 1·2-1·6 mm. long; rhachilla shortly produced as a short stipe .5 mm. long. *Glumes* sub-equal, about .75 mm. long, ovate, sub-acute, hyaline, obscurely 1-nerved. *Lower floret* barren; lemma lanceolate, acuminate, membranous, glabrous,

epaleate, 1-nerved. *Upper floret* hermaphrodite ovate, acute, ciliate with long erect white hairs; palea short, truncate. *Stamens* 2-3; anthers short. *Styles* free. *Grain* very minute free.

A very common grass up to 4,000 ft. The panicles are often used for making brooms.

16. ARUNDINELLEÆ.

Spikelets all alike, 2-flowered with the lower floret male or barren and the upper hermaphrodite, pedicelled in open or contracted, rarely spike-like panicles; rhachilla disarticulating between the florets, not produced above the upper floret; glumes more or less persistent, mostly acute or acuminate, membranous to coriaceous, the lower shorter, the upper as long as the spikelet; lower lemma similar to the upper glume, 3-9-nerved; upper lemma more or less terete, smaller than the lower, becoming 3-9-nerved, frequently awned from the entire or two-lobed tip, the awn usually geniculate and twisted below the knee, rarely awnless, often with a bearded basal callus; stamens 2 or 3; caryopsis tightly enclosed between the lemma and palea.

Annual or perennial herbs; leaf-blades linear to lanceolate.

Tropical and sub-tropical regions.

Key to the genera of *Arundinelleæ*.

Lemma of the upper floret scabrid or scabrous, entire or minutely 2-lobed at the apex, lobes awned or awnless. ..

1. *Arundinella*.

Lemma of the upper floret bearded below the 2 lateral prominent lobes.

2. *Danthoniopsis*.

1. ARUNDINELLA Raddi.

Spikelets lanceolate to ovate or ovate-elliptic or oblong, usually gaping, unequally pedicelled, continuous with or imperfectly jointed on the slender branches of open or contracted panicles; rhachilla glabrous readily disarticulating between the florets, and very slowly disarticulating or continuous between the upper glume and lower floret, not produced beyond the upper floret. *Florets* 2, heteromorphous; lower male or barren, very rarely hermaphrodite; upper hermaphrodite smaller than the lower. *Glumes* persistent, narrowly lanceolate to ovate or ovate-elliptic, acute or acuminate, membranous to chartaceous, 3-5-nerved, lower small-

er, mostly half to $\frac{3}{4}$ the length of the spikelet, upper as long as the spikelet. *Lower floret* sub-persistent; lemma ovate-oblong to oblong, obtuse or acute, sub-equal to the lower glume, thin, 3-7-nerved; palea narrow 2-keeled, from $\frac{1}{3}$ the length of, to as long as the spikelet. *Upper floret* narrow lanceolate to lanceolate-oblong, sub-terete or dorsally compressed, with a very short obtuse or truncate bearded or glabrous basal callus; lemma membranous, at length thinly coriaceous, finely 1-7-nerved, scabrid or scaberulous, entire, emarginate or minutely 2-lobed at the apex, with the lobes muticous or each bearing a capillary bristle, awned from the tip or the sinus of the two lobes or awnless; awn straight or curved or geniculate and twisted below the bend; palea narrow, 2-keeled, with the flaps more or less auricled. *Lodicules* 2, cuneate. *Stamens* 3. *Ovary* glabrous, styles distinct, stigmas plumose, laterally exserted. *Grain* oblong or ellipsoid, slightly dorsally compressed, tightly embraced by the lemma and palea; hilum punctiform; scutellum half the length of the grain or more.

Perennials or annuals; culms simple or branched; leaf-blades linear to lanceolate, usually flat; ligules very short, truncate; panicles usually rather stiff; spikelets 2 mm. to 1 cm. long, green, greyish, straw-coloured or purplish.

Key to the species of *Arundinella*.

Lobes of upper lemma bearing short capillary bristles :—

Spikelets 5-6 mm. long, panicle loose, central branches not verticillate. 1. *A. setosa*.

Spikelets 6-8 mm. long, crowded, usually covered with bulbous-based hairs, central branches verticillate. 2. *A. khaseana*.

Lobes of upper lemma without bristles :—

Fertile lemmas awned :—

Annual; spikelets 1.8-2 mm. long, leaf-blades lanceolate. 3. *A. pumila*.

Perennials :—

Spikelets villous; rhachis and branches densely villous; panicles narrow. 4. *A. villosa*.

Spikelets not villous; rhachis and branches not villous :—

Panicles contracted; rhachis long ciliate. 5. *A. intricata*.

- Panicles effuse, rhachis often scabrid :—
- Rhachis of panicle angular, scabrous glabrous; roots tuberous, not woolly. 6. *A. nepalensis.*
 - Rhachis of panicle filiform, scabrous; roots tuberous, densely woolly. 7. *A. mutica.*
- Fertile lemmas unawned, or only slightly so :—
- Branches of panicle 2·5-4 cm. long, short, stiff, spiciform. 8. *A. bengalensis.*
 - Branches of panicle 8-20 cm. long; very tall reed-like grass with long leaves. 9. *A. decempedalis.*

1. *Arundinella setosa* Trin. Gram. (1826) 63.

A perennial grass. Culms 60 cm. to 1 m. tall, smooth, glabrous, erect, from an almost woody rootstock, densely tufted; nodes smooth, glabrous, exserted from the leaf-sheaths. Leaf-blades narrow, up to 20 cm. long by 6 mm. wide, involute or sometimes flat-linear, tapering to a point, many-nerved, both surfaces hirsute-tomentose, margins minutely scabrid; sheaths rather loose, lower often persistent, coarsely hirsute with white or reddish hairs often from tubercle-bases, sometimes quite glabrous; ligule a narrow ring of very short dense, stiff hairs.

Inflorescence a loose panicle, lax, few branched, up to 15 cm. long, branches 5-12 cm. long, usually naked below; glabrous, smooth or very minutely scabrid. *Spikelets* 6·5-7·5 mm. long, seated on short or long pedicels, often paired, minutely scabrid. *Lower glume* 4 mm. long, ovate-acuminate, 3-nerved; nerves anastomosing below the tip, centre nerve prominent and produced into a short mucro, glabrous and smooth, or with a few hairs. *Upper glume* ·6 mm. long, 5-nerved, ovate-lanceolate, tip blunt or sharp, glabrous and smooth. *Lower floret* male; lemma ovate-lanceolate, 5-6-7-nerved, glabrous, almost enclosing the upper floret; palea lanceolate, hyaline, 2-keeled, margins infolded. *Stamens* 3, anthers 1·5 mm. long. *Upper floret* hermaphrodite, bearded on the callus; lemma 3 mm. long, 5-nerved, delicate setose up to 2·25 mm. long, lobes two, short, awn 8 mm. (or longer).

Common on the Shillong plateau. 5,000 ft.

2. Arundinella khaseana Nees ex Steud. Syn. Pl. Glum. (1854) 115.

A perennial. *Culms* robust, up to 2 m. tall, almost solid below; internodes smooth and glabrous or hairy and scabrid; nodes densely bearded or almost glabrous. *Leaf-blades* flat, or convolute, rather rigid, rough, margins serrulately-scabrid, glabrous or hirsute; sheaths smooth or scabrid, glabrous, striate, rather loose, or hirsute, margins very hairy; ligule a ridge of hairs.

Inflorescence a panicle, effuse, contracted or thyrsiform, 15-30 cm. long; rhachis stout, angled, scabrid to hirsutely scabrid, pedicels stout. *Spikelets* numerous or few, 7 mm. long. *Lower glume* lanceolate, 5-nerved, sparsely hairy on the nerves with long tubercle-based hairs; upper glume 6-7 mm. long, lanceolate, 5-nerved, with tubercle-based hairs on the nerves. *Lower floret* male, 6 mm. long, ovate-lanceolate, margins clasping the base of the upper floret, 5-nerved, glabrous; palea hyaline, ovate-oblong, 2-keeled, margins incurved. *Upper floret* hermaphrodite, callus bearded, ovate-oblong, 2-lobed, with the lobes continued into short aristae, 7-nerved, awned from the sinus, awn 6 mm. long, upper half scabrid lower smooth, strongly kneeled; palea as long as the lemma, 2-keeled; margins ciliate. *Stamens* 3; anthers 2.25 mm., linear.

Very common in the KHASI & JAITIA HILLS beside water courses or in dry situations. Normally flowers in August but has been found in flower in April-May.

Very common about Shillong, 5-6,000 ft.

3. Arundinella pumila Steud. Syn. Pl. Glum. (1854) 114. Syn. *A tenella* Nees ex Steud. Syn. Pl. Glum. (1854) 115.

A very slender annual. *Culms* up to 45 cm. long, prostrate or geniculately ascending, simple, smooth and glabrous or sparsely hairy, pubescent on the nodes. *Leaf-blades* lanceolate, contracted at the base and tapering to a fine point, up to 15 cm. long by 7.5 mm. wide, flaccid, glabrous or sparsely hairy; sheaths glabrous or sparsely pubescent; ligule short, hairy.

Inflorescence a very large, copiously branched panicle 5-25 cm. long; rhachis with scattered white hairs; branchlets and pedicels capillary, the latter up to 10 mm. long, usually much shorter. *Spikelets* ovate-acute in shape, pale green in colour, 2-2.5 mm. long. *Lower glume* 1.25-1.6 mm. long, ovate-acuminate, 3-nerved; upper glume 2.5 mm. long, 5-nerved. *Lower floret* male or rarely hermaphrodite; lemma 1.6-1.8 mm. long, glabrous, thinly membranous, 3-nerved. *Upper floret* hermaphrodite; lemma 1.25 mm. long, minutely scaberulous, 1-nerved, minutely 2-lobed; awn up to 3 mm. long.

Collected by C. B. Clarke near Umswai, KHASI & JAINTEA HILLS, 3,500 ft.

4. **Arundinella villosa Arn. ex Steud.** Syn. Pl. Glum. (1854) 115.

A densely tufted perennial. *Culms* slender sometimes stout, up to 45 cm. high, smooth, glabrous except below the panicle, leafy below. *The leaf-blades* are usually flat, strict rather rigid, sometimes involute or convolute, and may be glabrous tomentose or villous; sheaths rather loose, often densely tomentose, rarely glabrous, margins usually hirsute. *Ligule* a ridge of hairs varying greatly in length.

Inflorescence a contracted panicle consisting of short spiciform branches, upon which are borne a number of closely crowded spikelets seated upon short pedicels; rhachis and branches are either villous or hirsute; pedicels very hairy. *Spikelets* 6 mm. long shortly awned. *Lower glume* 5 mm. long, lanceolate, 5-nerved, with a number of tubercle-based hairs on the dorsal surface on the central 3 nerves, rarely as well on the outer two. *Upper glume* lanceolate-acuminate, 5-7-nerved, a number of hairs are borne on the nerves. *Lower floret* male; lemma membranous, 5.5 mm. long, 5-nerved, oblong-lanceolate, the central nerve continued into a blunt mucro; palea hyaline, margins infolded and lobed. *Upper floret* hermaphrodite, callus hairy at the base; lemma oblong-lanceolate, 3 mm. long, scaberulous on dorsal surface, broadly ovate-lanceolate, involute, awn 4.5 mm. long, scabrid to the

base, the lemma in shortly cleft and very shortly 2-lobed; palea as long as the lemma, indurated, involute with flaps.

Khasya is quoted as one of the habitats of this plant, but I have not been able to find any specimens at Kew. If it does exist it will be found between 3,000 and 4,000 ft.

5. Arundinella intricata Hughes in Kew Bull. (1920) 112.

A perennial grass. *Culms* 30-60 cm. tall from a geniculate base, densely caespitose, tall, strict, glabrous, 4 to 10-noded. *Leaf-blades* linear, drawn out to a fine point, 5-2·2 cm. broad, flat or involute, rigid or flaccid, glabrous or sometimes sparsely hairy on the upper surface; scabrid on the margins. *Leaf-sheaths* firm, striate, margins densely ciliate, the lower persistent; ligules very short, truncate, sometimes very densely fringed on the back.

Panicle oblong or ovate, contracted, 6·5-12·5 cm. long, 1·2 cm. broad; primary axis is angled and grooved, very conspicuously ciliate on the angles; branches solitary or 2-nate. *Spikelets* gaping, 4 mm. long; lower glumes ovate-acuminate, sometimes setaceous acuminate, 3 mm. long, distinctly 3-5-nerved; upper glume ovate, acute or acuminate, apex slightly recurved, 4 mm. long, 5-nerved. *Lower floret* male, very rarely female or hermaphrodite; lemma ovate, acute or acuminate, 4 mm. long, 5-nerved; palea ovate-oblong, acute, 3 mm. long; the lower part of the keels winged and the upper scaberulous. *Anthers* 1·5 mm. long. *Upper floret* hermaphrodite; lemma oblong, bifid, with an awn as long as or longer than the lemma; column short, chartaceous, minutely scaberulous; palea narrowly ovate, 2 mm. long, scabrous between the keels.

This grass is related to *A. nepalensis* Trin., but differs from it in its more or less contracted panicle, by the angles of the rhachis being plainly and definitely ciliate, by the lower glume being abruptly acute.

MISHMI, KHASI & NAGA HILLS, 4,600 ft.

6. Arundinella nepalensis Trin. Diss. II, 62. Syn. *A. brasiliensis* of F.B.I. VII (1897) 73 non Raddi.

This is a perennial grass and so variable that it is almost

impossible to give characters by which it may be known. The root-stock is hard and woody, creeping and sending out stout sheathed branches. The height of the culm varies from 30 cm. to 2 m. and may be stout and reed-like or very slender, smooth and glabrous, or hairy and scabrid, striate; nodes usually glabrous. Leaves flat, 15-30 cm. long, from 4 mm. to 1·8 cm. broad, flat, often involute, surface of the leaf often villous with long soft tubercle-based hairs, occasionally nearly glabrous with many longitudinal nerves and also cross nerves; sheaths somewhat loose, varying from hirsute, villous to almost glabrous; margins hirsute, with a tuft of hairs at the collar; ligule a ring of long or short, soft hairs.

The panicle varies from 10 cm.-45 cm. in length, the branches may be few to many, short or long, loosely spreading or contracted. Spikelets are distant or crowded, 3-4 mm. long; rachis and pedicels (long or short) are always more or less scabrid, and occasionally a few hairs like an involucre spring from the top of the pedicel. Lower glume 2·5 mm. long, ovate-lanceolate, 3-4-nerved, scabrid on the nerves; upper glume ovate-lanceolate, upper half strongly compressed, 5-nerved; smooth and glabrous. Lower floret male; lemma lanceolate, 5-nerved, ciliate on margins near apex; palea 2·5 mm. long, margins involute and lobed, fringed with long cilia; upper floret hermaphrodite; lemma 2 mm. long, ovate, truncate, obscurely 3-nerved, two obtuse lobes at apex, hairy in the callus, awn 3 mm. long, lemma very scabrid on the dorsal surface. Palea narrow-lanceolate, almost as long as the lemma, ciliate. Stamens 3, anthers 1·5-1·76 mm. purple.

The extreme forms of this plant look like distinct species but all intermediate stages are to be found.

A very common grass all over the province in hills and plains.

7. *Arundinella mutica* Nees ex Steud. Syn. Pl. Glum. (1854) 116. Syn. *A. capillaris* Hook. f. in F. B. I. VII (1897) 74.

A perennial grass. Culms very slender, erect from a tuberous rhizome clothed with the woolly bases of the leaf-

sheaths; nodes glabrous. *Leaf-blades* 15-30 cm. long, 4-8 mm. wide, linear, acuminate, tapering to the base, glabrous or hairy; ligule a ridge of hairs.

Inflorescence an oblong panicle, 10-18 cm. long; rhachis filiform, scaberulous; branches alternate, slender, 10-15 cm. long. *Spikelets* 4-5 mm. long, glabrous, solitary or in pairs; pedicels long, capillary, angular. *Lower glume* 3·2 mm. long, ovate, acute, 3-nerved, tapering to a long slender mucro, scabrid on the keel; upper glume up to 5 mm. long, ovate-lanceolate, 5-nerved; tip cuspidate-acuminate. *Lower floret* male; lemma 3-4 mm. long, ovate-oblong, subacute, 3-nerved; palea as long as the glume, oblong-lanceolate, acute, hyaline. *Upper floret* hermaphrodite; lemma as long as the lower lemma, lanceolate, acute, scaberulous; palea oblong-lanceolate, acute; awn nearly 6 mm. long, caducous.

Plains of LAKHIMPUR & SIBSAGAR.

8. Arundinella bengalensis Druce, Rep. Bot. Exchg. Club. Brit. Isles. (1916) 605. Syn. A. wallichii Nees ex Steud. Syn. Pl. Glum. (1854) 114.

A perennial grass. *Culms* stout, erect, up to 1 m. tall, often almost solid, smooth and glabrous, nodes glabrous or bearded. *Leaves* 30-45 cm. long, flat, lanceolate-acuminate; surface glabrous to villous with hairs from tubercle bases; margins minutely scabrid or not; sheaths loose, very hairy or not outside, persistent below, often hairy on the margins; ligule a ridge of long or short hairs, often supplemented by a tuft of stiff hairs in the throat.

The inflorescence consists of an elongate, erect, strict panicle; branches 2·5-3 cm. long, stout, spiciform. *Spikelets* 3-4-seriate, ovoid, secund, densely imbricate, stoutly pedicelled, setose; panicle up to 30 cm. long; rhachis angled and scabrid. *Lower glume* 2·5 mm. long, ovate-acute, 3-nerved, scabrid on the nerves; upper glume 3 mm. long, broadly lanceolate, 5-nerved, often hairy on the nerves. *Lower floret* male; lemma oblong-obtuse, 5-nerved; palea narrowly oblong, hyaline. *Upper floret* hermaphrodite; lemma 2 mm. long, callus very shortly bearded, scabrid, very obscurely 3-nerved,

almost ovate, apex abruptly narrowed into a short awn, 1.5 mm. long. *Stamens* 3, anthers 1.5 mm. long.

A very common grass in the plains and upto 6,000 ft.

9. Arundinella decempedalis (O. Ktze.) Janowski in Fedde, Rep. Spec. Nov. XVII (1921) 84. Syn. *A. clarkei* Hook f. in F. B. I. VII (1897) 75.

A tall, stout, reed-like perennial grass. *Culms* erect, up to 2 m. or more, by 2 cm. in diameter, smooth and glabrous. *Leaves* long, up to 1 m., by 2-4 cm. broad, lanceolate, flat, midrib very strongly marked; surface hispid or coarsely scabrid; margins finely scabrid; a tuft of long coarse hairs in the throat; sheath loose, somewhat inflated, perfectly smooth and glabrous; margins fimbriate; ligule a membranous ridge, supplemented by hairs.

The inflorescence is a large panicle up to 45 cm. long by 15 cm. broad; central axis smooth; branches rarely divided, often verticillate below, filiform, scaberulous; the lateral branches often exceeding 25 cm. in length. *Lower glume*, ovate-lanceolate, rather firm, 3 mm. long, 3-nerved, scabrid on the nerves; upper glume 3.75 mm. long, ovate-lanceolate, 5-nerved. *Lower floret* male; lemma broadly ovate-lanceolate, 5-7-nerved, tip obtuse, glabrous; palea 2.5 mm. long, hyaline, margins infolded, ciliate on the keels. *Upper floret* hermaphrodite; lemma 2 mm. long, callus bearded, ovate, somewhat obtuse at apex, nervation very obscure; palea narrow oblong, ciliate on the keels of the infolded margins. *Stamens* 3, anthers 1 mm. long, linear.

Plains of DARRANG.

2. DANTHONIOPSIS Stapf.

Spikelets lanceolate to ovate-lanceolate or lanceolate-oblong, paired or rarely in threes, pedicelled in open or contracted panicles; rhachilla glabrous, readily disarticulating between the upper glume and lower floret and between the florets, not produced beyond the upper floret. *Florets* 2; heteromorphous; lower male, upper hermaphrodite. *Glumes* persistent, scarious-membranous to chartaceous or rarely thinly coriaceous, 3-5-nerved, unequal; lower smaller

narrowly ovate to elliptic-ovate or elliptic-oblong, acute or obtuse, one-third to three-fifths the length of the spikelet. *Lower floret*; lemma similar to the upper glume, lanceolate to ovate-oblong, as long as or slightly shorter than the spikelet, 5-9- (rarely 3- or 11-) nerved; palea narrow, membranous, 2-keeled, with the keels very narrowly winged. *Upper floret* linear to oblong, slightly dorsally flattened or terete with a short bearded, very obtuse, truncate or 2-toothed basal callus; lemma membranous to coriaceous, 7-9-nerved, deeply bifid, with the lobes acute and sometimes produced into a fine scaberulous bristle, transversely bearded on the back either with a continuous beard beneath each lobe or with 6 to 8 distinct tufts of hairs, awned from the sinus between the two lobes; awn geniculate, twisted below the bend; palea similar to that of the lower floret, but the keels firmer and usually with wider wings, the wings usually bearing a lateral appendage at the apex. *Lodicules* 2, cuneate, fleshy. *Stamens* 3 in each floret; anthers linear. *Ovary* glabrous; styles distinct; stigmas plumose, laterally exserted. *Grain* oblong to obovate-oblong, grooved on one side; embryo up to half the length of the grain; hilum linear.

Perennial or annual grasses, culms simple, or branched towards the base; leaf-blades linear or lanceolate-linear, flat; ligule reduced to a fringe of hairs, panicle linear to oblong or ovate.

Danthoniopsis griffithiana Bor comb. nov. Syn. Arundinella griffithiana (C. Muell.) Bor in Ind. For. Rec. (Bot.) I. 3, (1938) 73; Danthonia griffithiana C. Muell. Bot. Zeit. XIV (1856) 348; Arundinella avenacea Munro ex Thw. Enum. Pl. Zeyl. (1864) 362.

A weak straggling slender grass. *Culms* up to 30 cm. high from a geniculate base, often decumbent for some distance, rooting at the nodes, finally erect, leafy to the top, often much branched; internodes smooth, somewhat hairy below the panicle; nodes glabrous. *Leaf-blades* flat, flaccid, cordate-amplexicaul below, tapering to a sharp point, many nerved, glabrous except for a few villae near the throat, up to 6 cm. long by 8 mm. broad; sheaths rather loose, glabrous,

striate, a few villae near the collar; ligule membranous, narrow, ciliate.

Inflorescence a compact ovate panicle; spikelets closely packed, seated on short, hairy, angled pedicels, sub-secund on the branchlets; branches and branchlets angled, hairy. *Spikelets* 5-6 mm. long. *Lower glume* including the awl 4 mm. ovate-acuminate, 3-nerved, ending in a short antrotorse scabrid awl; a few tubercle-based hairs are scattered over the back; upper glume including the awl 4.5-5 mm. long, ovate-lanceolate, 3-5-nerved; nerves prominent in the upper half, less so below; awl antrotorse scabrid, 1.5 mm. long, a few hairs on the back. *Lower floret* male; lemma ovate-lanceolate, embracing the upper floret, glabrous, 3.5 mm. long, 3-nerved, crowned by a very short awl. *Palea* 2 mm. long, hyaline, 2-keeled, truncate, erose at the top. *Anthers* 3, .5 mm. long. *Upper floret* hermaphrodite, bearded on the callus; lemma 3 mm. long, with two lanceolate awl-crowned lobes, 3-nerved; between the lobes issues an 8 mm. long awn, of which the lower 4 mm. are flat glabrous and smooth, and the upper portion scabrid. *The awn* is not a prolongation of the central nerve but the base is produced laterally at the foot; the lemma is hairy in the lower half and bears two lateral beards of long hair. *Palea* 2.2-2.5 mm. long, narrow, ciliate on the margins, ending in 2 well-defined points. *Anthers* 3, up to .75 mm long, linear.

A very common grass in marshy places in the hills above 4,500 ft.

17. PANICEÆ.

Annual or perennial grasses, with herbaceous, very rarely woody culms; leaf-blades linear to lanceolate or ovate; spikelets usually similar, hermaphrodite, rarely unisexual, solitary or paired, usually falling entire at maturity, 2-flowered with the lower floret male or barren and with or without a palea and the upper hermaphrodite, rarely with both florets hermaphrodite or the upper female or male, arranged on the usually continuous rhachis of solitary, digitate or scattered spikes or racemes or in open or contracted, sometimes spiciform, panicles; rhachilla not produced beyond the upper floret; glumes usually membranous, the lower usually smaller, sometimes very small or suppressed, the upper usually as long as the spikelet, or shorter, very rarely suppressed; lower lemma similar to the upper glume, at least in texture, rarely indurated; upper lemma and palea similar in texture, usually indurated, often chartaceous to crustaceous or at least firmer than the glumes, awnless, very rarely with a straight short awn from the apex; lodicules usually 2; stamens usually 3.

Key to the genera of *Paniceæ*.

Spikelets falling singly, not subtended by bristles, or if so, then the bristles persisting after the spikelets have fallen (*Setaria*) :—

Both florets fertile, or the lower male and then with the lemma hardened and similar to the upper :—

Upper lemma and palea membranous, gaping at maturity. ..

Upper lemma and palea indurated, closed at maturity.

Upper floret alone fertile; lemma of lower floret usually resembling the upper glume and not hardened :—

Spikelets arranged in more or less open panicles, or with the panicles contracted and spike-like :—

1. *Coelachne*.

2. *Isachne*.

Spikelets not sub-tended by bristle-like branchlets :—

Spikelets arranged in open or contracted panicles :—

Spikelets not or only slightly gibbosus :—

Fertile floret without lateral basal appendages or scars.

Upper glume as long as the spikelet. 9. *Panicum*.

Upper glume much shorter than the spikelet. 12. *Ottochloa*.

Fertile floret with lateral basal appendages or scars. 8. *Ichnanthus*.

Spikelets distinctly gibbosus and laterally much-compressed. 10. *Cyrtococcum*.

Spikelets usually arranged in cylindric al spike-like panicles; upper glume inflated.

Upper lemma and palea indurated and closed at apex; upper glume not inflated, spikelets lanceolate. 6. *Saccolpis*.

Upper lemma and palea membranous, gaping at apex. 7. *Hymenachne*.

Spikelets sub-tended by one to many bristle-like branchlets. 22. *Setaria*.

Spikelets arranged in one-sided spikes or spike-like racemes; spikes or racemes digitate or scattered, rarely solitary :—

Lemina of the upper floret more or less crustaceous or coriaceous, usually with narrow inrolled margins, exposing much of the palea :—

Spikelets dorsally compressed or almost terete, the glumes and lower lemma rounded on the back or only keeled at the tip :—

Lower glume and lowest internode of the rhachilla *not* forming a swollen callus at the base of the spikelet :—

Glumes and lemmas with lateral compressed and thickened apices. 3. *Acroceras*.

Glumes and lemmas not as above.

Lower glume (when present) turned away from the rhachis of the racemes or spike, the back of the upper lemma facing it, i.e., spikelets adaxial.

Lower glume developed, although sometimes small :—

Spikelets not sunken in hollows in a thickened corky rhachis :—

Glumes acuminate or awned, rarely only acute; upper lemma not mucronate :—

Leaf-blades linear;
racemes dense;
culms erect or
sub-erect .. 11. *Echinochloa*.

Leaf-blades lanceolate to ovate; racemes loose to moderately dense; culms creeping and ascending. .. 16. *Oplismenus*.

Glumes awnless, if acuminate, then with the upper lemma mucronate :—

Upper lemma acute,
not mucronate. 14. *Paspalidium*.

Upper lemma obtuse, mucronate or very short-awned. 15. *Urochloa*.

Spikelets sunken in hollows in a thickened rhachis, the latter disarticulating at maturity. .. 21. *Stenotaphrum*.

Lower glume usually absent; spikelets plano-convex. .. 13. *Paspalum*.

Lower glume turned towards the rhachis, the back of the upper lemma turned

away from it, i.e., spikelets
abaxial.

Lower glume present. . . 19. Brachiaria.

Lower glume absent. . . 20. Axonopus.

Lower glume and lowest in-
ternode of the rhachilla form-
ing a swollen callus at the
base of the spikelet; upper
lemma mucronate or short-
awned. 18. Eriochloa.

Spikelets laterally compressed,
obliquely ovate; upper glume
boat-shaped, with rows of glands
or hooked hairs or bristles
between the nerves. 17. Pseudechinolæna

Lemma of the upper floret thinly
cartilaginous, usually with flat
hyaline margins.

Spikelets awnless 4. Digitaria.

Spikelets awned.

Upper glume awnless. 5. Alloteropsis.

Upper glume awned. 25. Rhynchosleytrum.

Spikelets with an involucre of bristles or
sub-tended by a solitary bristle and fall-
ing with the bristles or bristle at
maturity, solitary or in clusters :—

Bristle solitary, formed by prolongation
of branch beyond terminal spikelet. . . . 23. Pseudoraphis.

Bristles usually numerous. 24. Pennisetum.

1. COELACHNE R. Br.

Spikelets ovate-oblong to oblong, small, awnless, paired
or solitary, pedicelled on the slender branches of open or
contracted panicles; rhachilla disarticulating above the glumes
and finally between the florets, glabrous, elongated, not pro-
duced beyond the upper florets. *Florets* 2, upper much
smaller, exserted from the glumes, gaping at the apex at
maturity; lower hermaphrodite, upper male, callus very
short, obtuse. *Glumes* persistent; obtuse or rounded at the
apex, rounded on the back, membranous, usually glabrous,
lower up to half the length of the spikelet, broadly ovate to
broadly elliptic, or sub-rotund, nerveless or obscurely 1-5-
nerved; upper as much as $\frac{2}{3}$ ds the length of the spikelet,
elliptic to broadly elliptic, ovate or sub-rotund 3-7-nerved;
nervation sometimes obscure. *Lemmas* obtuse, rounded on

the back; lower broadly ovate-elliptic to sub-rotund, with incurved margins, nerveless or obscurely few-nerved, becoming slightly indurated; glabrous or pubescent at the base; upper lemma oblong to elliptic, nerveless or few-nerved, remaining membranous, more or less pubescent especially near the margins or towards the base. *Paleas* as long as the lemmas, lanceolate-oblong to elliptic, obtuse, 2-keeled with inflexed margins, the lower at length slightly indurated, the upper membranous pubescent. *Lodicules* 2 in the lower floret, broad, minute. Stamens 2-3; anthers barren, oblong. *Ovary* glabrous, styles distinct, terminal; stigmas plumose in the lower floret, laterally exserted, in the upper exserted near the apex. *Caryopsis* ellipsoid, loose between the palea and lemma; scutellum $\frac{1}{2}$ the length of the grain; hilum basal.

Low annual or perennial grasses; culms very slender, weak, often ascending from a decumbent base; leaf-blades linear to lanceolate, usually flat, thin; ligule reduced to a fringe of hairs, panicle slender, linear to ovate in outline, loose or dense and spike-like, branches simple or sparingly divided.

Coelachne simpliciuscula Munro ex Benth. in Journ. Linn. Soc. XIX (1881) 93. Syn. *C. pulchella* R. Br. Prod. 187 (in part).

Annual. *Culms* 15-45 cm. tall, rather weak, slender or sometimes sub-robust, ascending from a somewhat decumbent base, leaves almost up to the panicle. *Leaf-blades* lanceolate, tapering to a point, minutely scaberulous above, nerves striate; sheaths often loose, striate, nodes bearded; ligule a rim of hairs.

Inflorescence a very variable panicle, 6-10 cm. long, very slender and spike-like or spreading with distant, spreading, filiform branches; the branches may be either stiff or flaccid, glabrous or hairy. *Spikelets* sessile or shortly pedicelled, globose or ovoid, pedicels up to 1 mm. long, glabrous. *Lower glume* 1 mm. long, nervation obscure, herbaceous, sub-rotund; upper glume 1.5 mm. long, herbaceous, sub-rotund; nerves very obscure. *Lower floret* hermaphrodite; lemma 2 mm. long, rounded on the back, coriaceous; palea 2 mm. long, almost glabrous, coriaceous, margins incurved. *Upper*

floret imperfect, neuter or female; stipitate on the rhachilla; lemma 5-1·25 mm. long, narrow lanceolate or ovate, membranous; palea of the same shape, size and consistency.

Common in the hills in marshy places.

2. ISACHNE

Spikelets elliptic to elliptic-oblong, semi-elliptic, obovate or orbicular in profile, obtuse, acute or acuminate, awnless, usually small or minute, pedicelled in open or contracted panicles; rhachilla not or very rarely produced beyond the upper floret, disarticulating between the glume and lower floret and usually between the florets, the glumes also at length deciduous; florets similar or dissimilar; lower male or hermaphrodite; upper male or hermaphrodite, frequently on a short rhachilla joint. *Glumes* equal or nearly so, more or less similar, but the upper usually wider, from 2/3 to quite as long as the spikelet, convex or the lower dorsally flattened membranous, glabrous or hairy, finely 5-9-nerved, or the lower 3-nerved. *Lower floret*: lemma narrowly elliptic-oblong to elliptic or orbicular in back view, obtuse or rounded at the apex, plano-convex, as long as the spikelet or exceeded by the glumes, finely membranous, chartaceous or thinly coriaceous, glabrous or minutely hairy, obscurely 5-7-nerved; palea as long as the lemma and similar in outline, 2-nerved, dorsally flattened, embraced by the narrow involute margins of the lemma. *Upper floret*: lemma similar to that of the lower floret or smaller, firmer in texture and often hairy; palea corresponding in outline to the lemma and similar in texture. *Lodicules* 2, minute, cuneate. *Stamens* 3; anthers linear or oblong; filaments short. *Styles* distinct, short; stigmas terminally exserted. *Caryopsis* obovate, elliptic or rotund in outline, plano-convex, enclosed between the lemma and palea; scutellum elliptic; hilum basal.

Annual or perennial often aquatic grasses; culms slender, erect or more often geniculately ascending from a prostrate base, rarely suffrutescent; ligule reduced to a ciliate rim, blades linear to lanceolate or ovate, usually closely and prominently nerved on the upper surface; panicles sparingly or much laxed; pedicels mostly with thick tips.

Key to the species of *Isachne*.

Lemmas similar in shape and texture and more or less in size; florets almost contiguous (Sect. Eu-*Isachne*).

Spikelets 2·2-2·5 mm. long; panicle 5-35 cm. long.

Leaf-blades ovate-lanceolate; smooth; spikelets 2·8-3·25 mm. long. 1. *I. clarkei*.

Leaf-blades linear to linear-lanceolate, scabrid; spikelets 1·2-2·5 mm.

Leaf-sheaths smooth; panicle 8-35 cm. long. 2. *I. albens* and var. *hirsuta*.

Leaf-sheaths rough; panicle 3-7·5 cm. long. 3. *I. scabrosa*.

Spikelets 2·5-1·8 mm. long; leaves scabrid, sheaths smooth; panicle up to 10 cm. long. 4. *I. himalaica*.

Lemmas dissimilar, the lower larger, thinner, glabrous or nearly so, the upper smaller; florets separated by a minute rhachilla joint (Sect. Para-*Isachne*).

Leaf-blades lanceolate or linear-lanceolate; spikelets 1·8-2 mm. long. 5. *I. dispar*.

Leaf-blades ovate-lanceolate; spikelets 1·2-2·5 mm. long. 6. *I. miliacea*.

1. *Isachne clarkei* Hook. f. F.B.I., VII (1897), 24.

A very slender species. Culms finally erect, often decumbent and creeping at first, often rooting at the lower nodes. Leaf-blades 2·5-9 cm. long, flat, 3-6 mm. wide, ovate-lanceolate, acute, very thin, almost membranous, nerves very numerous, both surfaces scabrous with scattered hairs, margins thickened, cartilaginous, minutely serrate; sheaths closely fitting or rather loose, glabrous and smooth or rarely with a few scattered hairs, striate, margins thin, hyaline; ligule a ridge of stiff, closely-set bristles.

Inflorcence a loose panicle, 5-7·5 cm. long, 3-5 cm. wide, pyramidal, branches up to 2·5 cm. long. Spikelets 1 mm. long or less, scattered on the spreading capillary branches, very minute, seated on pedicels which are slightly swollen at the tips and longer than the spikelets. Glumes and lemmas equal in length 1 mm. long; glumes herbaceous, many nerved, ovate, sparsely hairy on the back. Both lemmas

similar in shape, size and texture (cartilaginous) the lower containing a male flower and the upper hermaphrodite; involute at the edges, scabrid on the dorsal surface. *Palea* almost as long as the lemmas and compressed by them. *Anthers* 3, minute.

NAGA HILLS, 6,000 ft. KHASI & JAINTIA HILLS 4-6,000 ft.

2. *Isachne albens* Trin. Sp. Gram. Ic. (1828) t. 25.

A tall perennial. *Culms* erect, or spreading in diffused light, branched, 30 cm.-1·3 m. tall. *Leaf-blades* flat, linear to linear-lanceolate, 5-20 cm. long, .7 cm.-2·5 cm. in width, midrib and several other nerves on either side distinct, surface rough, the upper more so than the lower: margins cartilaginous, minutely toothed; sheaths rather loose, smooth, striate; ligule a ridge of stiff hairs.

Inflorescence a decompound panicle, 8-40 cm. long, up to 20 cm. broad, branches and pedicels capillary, at first strict, erect, finally spreading. *Spikelets* minute, globose. 1·2-5 mm. long. *Lower glumes* orbicular, glabrous, 1 mm. long, many nerved, thin, equaling the upper in size. *Lemmas* similar, cartilaginous, pubescent on the dorsal surface, orbicular, obtuse, margins infolded. *Lower floret* male, upper hermaphrodite; occasionally the lower also hermaphrodite; palea somewhat shorter than the lemmas, hyaline, embraced by the former. *Anthers* 2, minute.

Very common all over the province up to 4,500 ft.

Var. hirsuta Hook f. F.B.I., VII (1897) 23.

The glumes are pubescent on the back. The sheaths are very hirsute. Leaves rather broad.

SYLHET & CACHAR.

3. *Isachne scabrosa* Hook. f. F.B.I., VII (1897), 23.

A perennial grass. *Culm* woody, 3-1 m. tall, finally erect from a rambling, geniculate base, internodes polished, smooth and glabrous, nodes bare. *Leaf-blades* 8-15 cm. long, 8 mm. to 1 cm. broad, linear-lanceolate, tapering to a fine point, somewhat scabrous on both surfaces, pale beneath, midrib and 2 or 3 other nerves on either side very obvious, margins thickened; sheath loose, striate, margins ciliate, often

covered with stiff hairs from tubercle-bases; ligule a ridge of hairs.

Inflorescence a decompound panicle 5-10 cm. long, pyramidal; branches flexuous up to 7 cm. long; pedicels of the spikelets rather short. *Glumes* similar, membranous about 1.8 mm. long, many-nerved, setulose on the back. *Lemmas* orbicular, the lower 1.5 mm. long, the upper slightly smaller, rhachilla minute. *Lower floret* generally male but may be hermaphrodite, upper usually hermaphrodite, ovate, margins incurved. *Anthers* 3, .5 mm. long.

Common in the KHASI HILLS, 4-5,000 ft.

4. *Isachne himalaica* Hook. f. F.B.I. VII (1897), 23.

An erect perennial. *Culms* erect from the base, 30-60 cm. tall, stout or slender, stiff, smooth or glabrous. *Leaf-blades* flat, linear, ensiform, midrib prominent, scabrid, margins thickened and minutely serrulate, ciliate at the mouth, 3-13 cm. long, up to 9 mm. broad, usually strict; sheaths glabrous, but the margins are densely hirsute; ligule a ring of stiff hairs.

Inflorescence a pyramidal panicle with strict branches 2.5-3.5 cm. long, rhachis and branches smooth and glabrous. *Spikelets* 2.5-1.8 mm. long, globose. *Lower glumes* ovate, membranous, many-nerved, dorsal surface glabrous, scabrid or bristly. *Lower lemma* 1.5 mm. long, ovate-hemispherical. *Upper lemma* usually smaller on the minute rhachilla joint. *Lower floret* usually male, upper hermaphrodite. Both of them of the same texture, i.e., chartaceous. *Stamens* 3; anthers .5 mm. long.

Common in marshes in the KHASI HILLS, 4-5,000 ft.

5. *Isachne dispar* Trin. Sp. Gram. Ic. (1828) t. 86.

Stems at first creeping and branching on the ground rooting at the nodes, and sending up flowering shoots from the nodes, finally erect 5-15 cm. high, sometimes even to 30 cm. tall, smooth and glabrous. *Leaf-blades* flat, rather stiff, striate, 1.5 cm. long, from ovate, tapering to a point, to lanceolate-acuminate, base usually cordate, scaberulous, margins thickened; sheaths rather loose, smooth, glabrous, shining,

ciliate at the mouth, margins shortly ciliate; ligule a very narrow, membranous ring fringed with long cilia.

Inflorescence a panicle, contracted and ovoid, or pyramidal and open, branches glabrous or obscurely scaberulous and very variable in length as are also the pedicels. *Spikelets* green or purplish, obtuse, 1·2-5 mm. long, smooth and polished, or scabrid and setulose. *Glumes* membranous, faintly many-nerved. *Lower floret*; lemma ovate-oblong, 2 mm. long, shining, thin, glabrous, smooth, enclosing a male flower, palea hyaline. *Upper floret* hermaphrodite; lemma coriaceous or chartaceous, 1·5 mm. long or less. *Stamens* 3. *Anthers* 1·25 mm.

GOALPARA.

6. *Isachne miliacea* Roth, Nov. Pl. Sp. (1821), 58.

A very variable plant. *Stems* often creeping upon the ground, branching at the nodes, finally erect, rarely reaching 20 cm. tall; internodes glabrous and smooth, nodes glabrous or ciliate. *Leaves* flat, small, 1-2.5 cm. long, 5 mm. broad, flaccid or firm, very finely nerved, margins slightly thickened, smooth, glabrous or very slightly hairy on both surfaces; sheaths closely fitting or rather loose, striate, glabrous but densely ciliate on the margins; ligule hardly membranous, almost entirely a ridge of cilia.

Inflorescence a panicle, loose or contracted. *Spikelets* 1·2-1·6 mm. long, globose, few in number and distant, seated on short or long, capillary pedicels. *Glumes* orbicular-oblong, almost hemispheric in outline, obscurely 7-nerved, often sparsely covered with long hairs. *Lower floret* male; lemma somewhat longer than the upper lemma, membranous; upper floret female; lemma smaller, coriaceous, hemispheric in profile; palea glabrous.

Common in marshes in the plains.

3. ACROCERAS Stapf.

Spikelets ovate-oblong to oblong, bluntly and thickly crested, sub-terete, falling entire from the pedicels, usually 2-nate or upwards solitary, more rarely fascicled, secund and abaxial on the angular rhachis of racemously arranged,

mostly loosely, simple or sometimes compound, spiciform racemes; lower floret male or barren with a well-developed palea; upper floret hermaphrodite. *Glumes* sub-similar, membranous, pale below, greenish upwards or green all over, with a thick, dark green, laterally compressed, terminal crest, which is the end of a short sub-terminal keel; the lower usually shorter, more or less ovate-lanceolate and 3-nerved; the upper oblong, 5-nerved. *Lower floret* equalling the upper glume or almost so; lemma very similar to the upper glume; palea equal to the lemma or slightly shorter, hyaline, finely 2-keeled. *Upper floret*; lemma subcoriaceous, smooth, oblong, very obscurely keeled or broadly rounded on the back, with a blunt callous, green, laterally compressed, apical crest, narrowly involute with firm margins, faintly 5-nerved; palea equalling the lemma and similar in substance with rounded keels, each ending in a minute, more or less recurved callous tip. *Lodicules* 2, cuneate, fleshy. *Stamens* 3. *Styles* distinct; stigmas large, plumose, dark, exserted laterally above the middle. *Grain* tightly enclosed between the hardened lemma and palea, oblong, dorsally flat, ventrally convex; hilum filiform, as long or usually much shorter than the grain, rarely punctiform. *Embryo* obovate short.

Perennial or annual, usually with a long prostrate and rooting base; blades lanceolate to linear, often from a sub-amplexicaul or amplexicaul base; ligules reduced to a ciliolate rim or quite obscure: panicles of distant slender secund spiciform or racemiform branches mostly bearing spikelets from the base or near it; spikelets quite glabrous and smooth.

Key to the species of *Acroceras*.

Spikelets close on the panicle branches.

- | | | |
|-------------------------------------------|----|-------------------------------|
| Spikelets over 5 mm. long. | .. | 1. <i>A. zizanioides</i> . |
| Spikelets less than 4·5 mm. long. | .. | 2. <i>A. crassiacapicula-</i> |
| | | <i>tum</i> . |
| Spikelets widely spaced. | .. | 3. <i>A. tonkinense</i> . |

1. *Acroceras zizanioides* (H.B.K.) Dandy, Journ. Bot. LXIX (1931) 54. Syn. *Panicum latifolium* Hook f. F.B.I. (1897) 39 (in part, not of Linn.).

Perennial. *Culms* ascending from a prostrate base often rooting at the nodes, reaching 60-120 cm. in height, simple

or sparingly branched, internodes very smooth and glabrous, somewhat compressed below. *Leaf-blades* lanceolate to lanceolate-linear from a broad suddenly constricted rounded base, tapering to a long, fine point, 7.5-12.5 cm. long by 1.2 cm. broad, spreading, firm, flat, glabrous or very finely pubescent and ciliate on the round base, smooth, margins finely scabrid; sheaths tight, firm, terete, striate; margins densely ciliate; ligules very narrow, membranous, ciliolate or almost suppressed.

Inflorescence a panicle, straight or nodding, 7.5-25 cm. long, made up of several, sub-erect, interruptedly spiciform or racemiform branches, distantly disposed on a central rhachis, which is angled and channelled; branches hairy at the base; pedicels short to long, scaberulous, tips truncate. *Spikelets* lanceolate-oblong, bluntly apiculate, 5.7-5 mm. in length. *Lower glume* lanceolate, base ovate, 2/3-4/5 the length of the spikelet, 3-5-nerved; middle nerve shortly keeled upwards; upper glume length of spikelet and same shape, 3-nerved, with laterally compressed, thick, blunt tip. *Lower floret* barren; lemma very similar to upper glume; palea reduced, oblong, acute, keels finely scaberulous. *Upper floret* hermaphrodite; oblong, 5 mm. long, lemma coriaceous, mucronate, minutely rough below mucro, tips of palea subcrenulate, slightly recurved, palea same texture as lemma. *Anthers* 2.2-5 mm. long.

Very common in the ASSAM VALLEY.

2. *Acroceras crassiacapitatum* (*Merr.*) *Burkill* in Kew Bull. (1935) 317. Syn. *Panicum latifolium* *Hook.* f. loc. cit. not of Linn.

A (annual ?) perennial grass. *Culms* slender, shortly erect from a widely creeping base, many noded, the lower emitting solitary and 2-3-nate roots, smooth and glabrous, except for a tuft of hair below the panicle; internodes longer than the sheaths. *Culms* prominently striate, 15-30 cm. high. *Leaf-blades* flat, somewhat firm, lanceolate, or narrowly ovate-lanceolate, tapering to a blunt tip from a rounded or subcordate base, 2-6 cm. long, 4-8 mm. broad, glabrous on both surfaces or rarely ciliate on the rounded base, minutely rough;

margins scabrid; sheaths persistent, loose below, close fitting above, striate, smooth and glabrous except for the outer margin of the sheath which is always ciliate; ligule obsolete.

Inflorescence a panicle 3-6 cm. long, consisting of few, sub-erect, interruptedly spiciform or racemiform branches disposed on a short, central rhachis which is deep channelled; branches hairy at the junction with the rhachis; pedicels short, or long, never exceeding the spikelet in length; spikelets ovate-lanceolate in shape, bluntly apiculate, 4.5 mm. long or shorter. *Lower glume* lanceolate from a clasping, ovate base, 3.25 mm. long, tip compressed, 3-nerved; upper glume as long as the spikelet, 7-nerved, tip compressed. *Lower floret* barren; lemma 4 mm. long, broadly ovate, apiculate, 7-nerved; tip thick, compressed; palea ovate-oblong, keels finely scaberulous, almost as long as the lemma. *Upper floret* hermaphrodite; lemma ovate, apiculate, 3.25 mm. tip compressed, smooth, shining, subcoriaceous, mucronate, markedly compressed; palea of the same size as the lemma and of the same substance.

LAKHIMPUR & SIBSAGAR.

3. **Acroceras tonkinense** (*Balansa*) C. E. Hubbard ex Bor, Ind. For. Rec. (Bot.) I. 3. (1938) 78. Syn. *Panicum tonkinense* Bal. in Morot, Journ. de Bot. IV (1890) 140; *P. latifolium* L. var. *majus* Hook f. F. B. I. VII (1897) 39; *Neohusnotia tonkinensis* A. Camus in Bull. Mus. Paris (1920) 664. .

A perennial herb with a creeping rhizome. *Culms* rooting at the base, almost erect or scrambling, branched, with numerous pubescent nodes. *Leaf-blades* linear-lanceolate in shape, acuminate, cordate at the base, flat, 10-20 cm. long, 1.5-3 cm. broad, covered with a short pubescence above or glabrous; margins coriaceous, often undulate, scabrid, with a few cilia at the base; sheaths somewhat loose, open, striate, pubescent; ligules very short lacerate.

Inflorescence a panicle, 15-30 cm. long, very open; main axis robust, angled, grooved, scabrid; branches few, erect, triquetrous, scaberulous, 2-15 cm. long carrying 2-5 pairs of spikelets. *Spikelets* pedicelled (one pedicel 3-4 mm., the

other 10-25 mm. long, swollen at the apex) distant, ovate-lanceolate, compressed at the apex, somewhat inflated, 4·5-5·5 mm. long. *Lower glume* 4·4-5 mm. long, clasping, ovate, shortly keeled at the apex, abruptly mucronate, 5-nerved; upper glume 4·5-5·5 mm. long, ovate, shortly keeled and compressed at the apex, 5-nerved. *Lower floret* male; lemma 4·5-5·3 mm. long, somewhat coriaceous, ovate, rounded on the back, compressed and hairy at the apex, 5-nerved; palea 3·5-4 mm. long, thin, linear-lanceolate. *Upper floret* hermaphrodite, shortly stipitate; lemma 5 mm. long, coriaceous, smooth, shining, ovate, compressed at the apex, 5-nerved; palea 3·5-4·5 mm. long, ovate, 2-nerved. *Lodicules* 2, thick, ovate, auricled. *Stamens* 3. *Ovary* oblong, glabrous.

This grass has been gathered twice in the SURMA VALLEY. It is considered to be a good fodder grass in COCHIN-CHINA.

4. DIGITARIA Rich.

Perennials or annuals. *Leaves* linear or linear-lanceolate, often flat. *False spikes* often in clusters, digitate or more or less spaced on a common axis, solitary or rarely pedunculate and forming a panicle, simple or sometimes compound towards the base; rhachis triquetrous or flat, with the angles often herbaceous, winged; pedicels unequal. *Spikelets* narrowly appressed and imbricate, rarely distant, lanceolate or elliptic-oblong, plano-convex, caducous, often 2-3-nate, 2-flowered; the lower reduced; appearing glabrous by reason of the very fine mat of hairs in lines between the nerves, rarely glabrous; lower glume often small, (sometimes 0), hyaline; upper muticous, membranous, shorter than the spikelet, rarely larger, 3- (rarely 0- or 5-) nerved. *Lower floret* neuter; lemma often like the upper glume 3-9-nerved, nerves straight, parallel, strong; palea very small. *Upper floret* hermaphrodite; lemmas papyraceous; 1-3- (rarely 5-) nerved, palea almost as large and of the same texture, 2-nerved; the margins of the lemma spread over the face of the palea leaving little of it exposed. *Lodicules* 2, small, broadly cuneate. *Stamens* 3. *Ovary*;—styles distinct; stigmas laterally exserted towards the summit of the spike-

let. *Caryopsis* narrowly enclosed between the scarcely indurated lemma and palea, oblong, slightly compressed; hilum basal, punctiferous; embryo not half the length of the caryopsis.

Key to the species of *Digitaria*.

Spikelets 2·3·5 mm. long, glabrous or fringed with fine, acute hairs.

Spikelets lanceolate to lanceolate-oblong.

Spikelets 3·3·5 mm. long; nerves in lower lemma evenly spaced; racemes 10-15 cm. long and finely pubescent at the base; rhachis broad, .7-1 mm.

Spikelets 2·2·5 mm. long; lateral nerves of lower lemma near the margin; racemes 6-10 cm. long; rhachis slender. ..

Spikelets ovate to elliptic.

Racemes numerous, 8-15 cm. long; spikelets dense; tall grass, cultivated.

Racemes few, up to 8 cm. long; spikelets loose.

Spikelets less than 2 mm. long, or, if slightly longer, with very short curled or matted hairs.

Pedicels prominent, spreading, 3 mm. long; spikelets spreading, rather loose, rhachis very slender triquetrous.

Spikelets minutely pubescent; panicle 15-25 cm. long; racemes 15 cm. long. ..

Spikelets glabrous or almost glabrous; panicle 4-8 cm. long; racemes 4-8 cm. long. ..

Pedicels very short, 1 mm. long; spikelets appressed close toge'her; rhachis flattened.

Lemma and palea of the upper floret brown or black; annual grasses with erect or ascending culms.

Spikelets 1·5-2·3 mm. long; upper glume as long as or rarely as long as the spikelet.

Spikelets 1·5-1·7 mm. long. ..

Spikelets 2·2-3 mm. long, peduncle hairy; hairs clavate-tipped. ..

Spikelets about 1 mm. long, upper glume very short; hairs clavate tipped. ..

Lemma and palea of the upper floret pale; spikelet 1·3-1·5 mm. long, upper glume as long as the spikelet; creeping perennial. 10. *D. longiflora*.

1. *D. adscendens*.

2. *D. pruriens*.

3. *D. corymbosa*.

4. *D. bifasciculata*.

5. *D. jubata*.

6. *D. pedicellata*.

7. *D. violascens*.

8. *D. ternata*.

9. *D. royleana*.

I. **Digitaria adscendens** (H. B. K.) Henr. in Blumea I (1934) 92. Syn. *Panicum adscendens* H. B. K. Noy. Gen. et Sp. (1815) 97.

An annual. *Culms* 30-60 cm. high, tufted, ascending from a geniculate or prostrate, often rooting base, simple or branched at the lower nodes, glabrous. *Leaf-blades* linear-lanceolate to linear, from a slightly contracted and rounded base, tapering to a sharp point, up to 12·5 cm. long by 4-8 mm. wide, flat, flaccid, glabrous or sparingly hairy towards the mouth; margins finely cartilaginous, rough; sheaths thin, loose, glabrous or with spreading tubercle-based hairs forming a loose beard at the base; ligules membranous, truncate up to 1 mm. long.

Racemes 4-9, sessile, subdigitate, solitary or 2-3-nate on an angular, scaberulous axis, erect or spreading, slender, striate or flexuous, 5-15 cm. long, finely pubescent at the base; rhachis almost straight, triquetrous, lateral angles winged, scabrid; pedicels 2-nate, one very short, the other up to 1·5 mm. long, angular, scabrid. *Spikelets* appressed, not or only slightly imbricate, lanceolate, acutely acuminate, 2-3 mm. long, pale-green, rarely tinged with purple, variously hairy, rarely quite glabrous. *Lower glume* an ovate, obtuse to subacute, membranous scale, usually not above 4 mm. long, sometimes obsolete or suppressed; upper ovate-lanceolate, acute, equaling, or more often exceeding considerably, half the upper floret, 3-nerved, with fine lines of hairs between the nerves and along the margins, rarely quite glabrous. *Lower floret* sterile; lemma membranous, corresponding in shape and size to the spikelet, 7-nerved, nerves smooth, rarely glabrous, palea and lodicules minute. *Upper floret* hermaphrodite; lemma oblong-lanceolate, acutely acuminate, almost as long as the spikelet, thinly chartaceous, pale or slightly purplish, brown when mature; palea of same texture. *Anthers* 3, .75 mm. long. *Caryopsis* oblong, 1·6 mm. long, plano-convex, whitish; scutellum less than $\frac{1}{2}$ the length of grain.

Common everywhere.

2. Digitaria pruriens Buese in Miq. Pl. Jungh. (1854) 379. Syn. *Paspalum sanguinale* Hook f. F.B.I. VII (1897) 16 (in part) non Lamk.

Culms decumbent and creeping at the base, branching, often channelled and compressed, nodes few, slightly swollen and kneed. *Leaves* 2·5-15 cm. long, 4-6 mm. wide, linear-lanceolate, very acute, margins white, often with long white tubercle based hairs near the mouth, more or less hairy or rough; sheaths rather loose and more or less hirsute especially the lower; ligules membranous, 2 mm. long, long truncate.

Inflorescence a panicle of 3-9 false spikes (rarely) 12) erect, contracted, green; rhachis narrow, ·3-·5 mm., flexuous, hispidulous; pedicels 2-nate, the smaller ·5 mm. long, the other 2·2-2·5 mm. long. *Spikelets* 3 mm. long, linear-lanceolate or lanceolate-elliptic, acute appressed; lower glume small or absent; upper glume ·8-1·2 mm. long, oblong, 3-nerved, glabrous or ciliate. *Lower floret*; lemma 3 mm. long, linear-lanceolate, acute, 7-nerved, glabrous and slightly villous on the nerves and at the apex; palea absent. *Upper floret* hermaphrodite; lemma coriaceous and finally white, cartilaginous, glabrous 2·8 mm. long, convex elliptic-lanceolate, acuminate; palea of the same texture as the lemma 2·8 mm. long.

Common, up to 4,000 ft.

3. Digitaria corymbosa (Roxb.) Merr. Enum. Philip. Fl. Pl. I. (1925) 53. Syn. *Panicum corymbosum* Roxb. Hort. Beng. (1814) 7.

Annual. *Culms* tufted, widely creeping below and rooting at the nodes, stout or slender, smooth and glabrous up to 1·5 m. tall. *Leaves* linear to linear-lanceolate, up to 20 cm. long by 1-2 cm. broad, surfaces rough, flat, flaccid, base rounded or tapering, margin thickened and scabrid; (a few hairs with tubercle bases at the junction of the blades and sheath on the margin); sheath loose, striate; ligule membranous, truncate, 2 mm. long.

Inflorescence made up of racemes of spikelets, up to 20, 10-15 cm. long, subdigitately arranged on a short common

axis, rhachis narrowly winged, margins scabrid; pedicels angled, scabrid on the angles, 2-nate. *Spikelets* elliptic-acute, about 3 mm. long; lower glume a small hyaline scale; upper glume half the length of the upper lemma and much narrower, lanceolate, ciliate on the margin, 3-nerved, sparsely hairy on the dorsal surface; lower floret sterile; lemma membranous, hyaline 5-7-nerved, equalling the spikelet in shape and size, hairy on the lateral nerves or pubescent; palea absent. *Upper floret* hermaphrodite; lemma elliptic-acute, almost apiculate, chartaceous, pale, shining, minutely punctate; margins inturned and clasping the palea; palea of the same substance; flaps covering ovary and stamens. *Anthers* 1.75 mm. long.

Merrill loc. cit. "the spikelet is distinguished by the almost obsolete 1st glume, and short 2nd glume, the latter rarely more than $\frac{1}{2}$ as long as the spikelet."

Extensively cultivated at 5-6,000 ft. in the KHASI HILLS.

4. Digitaria bifasciculata (Trin.) Henr. Meded. Rijks. Herb. no. 61 (1930) 60, based on *Panicum bifasciculatum* Trin. Gram. Panic. (1826) 76. Syn. *Panicum cruciatum* Nees ex Steud. Syn. Pl. Glum. (1854) 39.

An annual. *Culms* 50-80 cm. tall, ascending, robust, glabrous with puberulous nodes, the lower often rooting. *Leaf-blades* spreading, lanceolate, acuminate, with the base slightly contracted, firm, flat, margins scaberulous, 5-20 cm. long by 5-8 mm. wide; sheaths open, glabrous; ligule membranous, truncate, 3 mm. long.

Inflorescence made up of several false spikes, the lower spreading, often flexuous, almost panicle-like, 5-8 cm. long; main axis often flexuous, scarcely thicker than the rhachis of the false-spikes, 1-1.3 mm. broad, triquetrous, wing developed, margins scaberulous, internodes 3 mm. long; pedicels 2-nate, the lower 1.75 mm. long, the upper 1.75-2.5 mm. long. *Spikelets* greenish or violet, 3-3.5 mm. long, ovate-oblong, acute, or cuspidate-acuminata, rather laxly imbricate, glabrous or nearly so. *Lower glume* very small or absent; upper glume 1.5-1.7 mm. long, ovate-oblong, obtuse, 3-nerved, often hairy on the margins. *Lower floret* sterile;

lemma 3-3·5 mm. long, ovate-oblong, obtuse, 7-nerved, margins often scantily hairy. *Upper floret* hermaphrodite; lemma 3-3·5 mm. long, ovate, cuspidate, acuminate, rather turgid.

This is perhaps the wild plant of *D. corymbosa*; the two are very close together.

Common in plains and hills.

**5. *Digitaria jubata* (*Gris.*) *Henr.* in *Blumea* I (1934)
100. Syn. *Paspalum jubatum* *Gris.* in *Goett. Nachr.* (1868)
84.**

An annual. *Culms* 6-1·3 m. high, erect or from a shortly decumbent base, rooting at the lower nodes, rather stout, shiny, simple or branched, smooth and glabrous. *Leaf-blades* 15-25 cm. long, 4-6 mm. wide, linear or linear-lanceolate, tapering to a fine point, many nerved, median nerves prominent, smooth and glabrous or upper surface and margins rough; sheaths loose and falling away from the culms, striate, smooth and glabrous, or lower sheaths hirsute with appressed short hairs; ligule 2 mm. long, membranous, rounded.

Inflorescence a panicle 15-25 cm. long, of many false spikes on a stout central axis; axis slightly twisted, angled, striate and channelled, scabrid on the angles or glabrous; racemes 10-15 cm. long often whorled below, flexuous, fine, narrow, scaberulous, hairy at junction with axis bearing very secund spikelets; spikelets 1·25-1·75 mm. long, elliptic or obovate-elliptic, pubescent, 1- or 2- to more-nate; spikelets green or purplish; pedicels up to 5-8 mm. long, flexuous, scabrid, with discoid tips. *Lower glume* absent; upper glume almost as long as the spikelet, membranous, oblong-obtuse, pubescent on the dorsal surface, obscurely nerved. *Lower floret* barren; lemma membranous, oblong or broadly oblong-obtuse, 5-nerved, pubescent on the dorsal surface, shortly ciliate on the margins; palea absent. *Upper floret* hermaphrodite; lemma broadly ovate-acute, brown or pale, shining, striate, 1·5 mm. long, margins broad, almost covering the palea; palea of the same substance as the lemma,

narrowly ovate-acute, smooth, striate, with margins infolded.
Stamens 3, linear-oblong, .75 mm. long.

Plains of both VALLEYS.

6. **Digitaria pedicellaris** Prain, Beng. Pl. (1903) 1182. Syn. *Paspalum pedicellare* Trin. ex Steud. Nom. Ed. 2. II (1841) 272.

An erect herb (annual or perennial). *Culms* 15-70 cm. tall, slender, tufted, branched and kneeled at the base. *Leaf-blades* narrowly linear-lanceolate, finely acuminate, flat or rolled, glabrous or pubescent, 5-15 cm. long, 2-4 mm. broad, margins minutely scabrid; sheaths narrow, the lower hairy; ligules short, scarious.

Inflorescence a panicle of 5-10 false spikes or racemes, slender, alternate, sub-terminal, contracted, erect or spreading, lax, 2.5-10 cm. long, rhachis very slender, hardly winged, margins minutely scabrid; pedicels 2-5-nate, unequal, slightly swollen at the tip, scaberulous. *Spikelets* ovate or elliptic, acute, mucronate, spaced, 1.25-1.5 mm. long; the upper of each fascicle on a pedicel which exceeds the lower spikelet in length. *Lower glume* absent, upper 1 mm. long, elliptic, acute or ovate-oblong, membranous, 5-nerved; hairs very slender, with thin smooth walls, .25-.35 mm. long, slightly swollen at the tip. *Lower floret* sterile; lemma 1.1-1.25 mm. long, membranous, ovate-oblong, acute, 5-nerved pubescent. *Upper floret* hermaphrodite; lemma 1.25-1.5 mm. long, coriaceous, brownish or yellowish, elliptic-oblong, acuminate, mucronulate, delicately punctate, with much incurved margins; palea narrower, of the same length as the lemma, coriaceous, brownish or yellowish, elliptic-oblong or ovate-oblong, with strongly incurved margins.

In the plains and foothills.

7. **Digitaria violascens** Link, Hort. Berol. I (1827) 229.

Annual. *Culms* up to 45 cm. long, from a prostrate and straggling base, rooting at the nodes, smooth and glabrous. *Leaf-blades* 6-20 cm. long, 4-7 mm. wide, linear to narrow linear-lanceolate, tapering to a very fine point,

gradually contracted at the base, somewhat rough on both surfaces, flat, flaccid; margins scarcely thickened, scabrid; sheaths rather loose, shorter than the internodes, smooth and glabrous; ligules short, membranous, truncate.

Inflorescence made up of about 5 false spikes or racemes, very often subdigitate, slender, 8-13 cm. long, erect or slightly curved outwards; rhachis .8 mm. wide, flat with a very prominent midrib, wing definite, scabrid; peduncles 2-nate, one longer than the spikelet and the other shorter. *Spikelets* biseriate, imbricate, elliptic-oblong, acute, glabrescent or silky, 1·2-1·7 mm. long. *Lower glume* very short or absent; upper glume 1·2-1·7 mm. long, convex, ovate-oblong, 5-7 nerved, silky, hairs thin and appressed. *Lower floret* sterile; lemma rather like the upper glume, somewhat longer and flat, 5-7-nerved. *Upper floret* hermaphrodite; .8-1·5 mm. long, oblong-lanceolate, acute, somewhat coriaceous, smooth or minutely punctate, brownish black or purple black; margins incurved; palea a little shorter than the lemma, of the same texture and substance; margins strongly incurved.

KHASI & JAINTIA & NAGA HILLS, 3,5000 ft.

8. Digitaria ternata Stapf in Dyer, Flor. Cap. VII,
376. Syn. *Paspalum ternatum* Hook. f., F. B. I. VII (1897)
17.

Annual. *Culms* fascicled, erect or decumbent below, 15-50 cm. long, simple, rarely branched, tufted, peduncle long exserted. *Leaf-blades* up to 20 cm. long, 4-8 mm. wide, linear-lanceolate or linear, glabrous or slightly rough, flat, flaccid, margins minutely scabrid; a few cilia with tubercle-bases on the margin of the rounded base; sheath smooth and glabrous or with a few white hairs, striate, rather loose; ligule short, membranous, truncate.

Inflorescence of 3-5 subdigitate racemes on a short common axis up to 12·5 cm. long, usually only 8 cm. long; rhachis flat, narrowly winged; margins scabrid; midrib prominent; pedicels 2-3-nate, hispidulous, with a tuft of hairs at the slightly swollen tips. *Spikelets* elliptic-oblong,

obtuse, 1·1-2·5 mm. long, appressed, subimbricate. *Lower glume* absent, upper shorter than the upper lemma and much narrower, 3-nerved with 4 lines of clavate-tipped silvery hairs often forming a dense fringe at the margins; lower floret neuter; lemma oblong, sub-acute, equaling the spikelet in shape and size, margins embracing the spikelet, 5-7-nerved, more or less densely covered with clavate-tipped hairs, fringed on the margins. *Upper floret* hermaphrodite; lemma chartaceous, brown, elliptic, subacute margins strongly incurved, overlapping at the apex; palea of the same shape, colour and substance as the lemma, margins incurved.

KHASI & JAITIA HILLS, 4,500 ft.

9. Digitaria royleana Prain, Beng. Pl. (1903) 1182.
Syn. *Paspalum royleanum* Nees ex Thw. Enum. Pl. Zeyl. (1864) 358.

An annual. *Culms* erect or short, geniculate at the base, tufted, up to 50 cm. tall, very slender, smooth and glabrous. *Leaf-blades* linear to lanceolate, tapering gradually to a fine point, flat, flaccid, usually 6-10 cm. long, in robust specimens up to 20 cm. long, 2-3 mm. wide, many-nerved, midrib prominent, scarcely rough on both surfaces, margin minutely scabrid, glabrous or with scanty or dense, white, long villæ from tubercle-bases; sheaths rather loose, striate, rough or smooth, glabrous or with numerous white hairs from tubercle-bases; margins glabrous or densely hirsute, throat hairy; ligules reduced to a membranous rim, ciliate or not.

Inflorescence a panicle made up of 3-6 (or rarely more) racemes sometimes subdigitate, usually alternate. *Racemes* 4-8 cm. long (in robust specimens up to 20 cm.), ascending, finally slightly recurved; rhachis flat, flexuous, winged, margins scabrid, slightly convex on the back; pedicels 1-2-3-nate, usually 2-nate, flexuous or straight; less than or equal to the length of the spikelet or longer, scabrid and/or with setæ, tip slightly swollen, usually with a few long cilia at the base of the spikelet. *Spikelets* 1·1-2·5 mm. long, elliptic, broadly oblong, acute, imbricate, very numerous. *Lower glume* absent; upper glume absent or represented by a few hairs thus exposing the whole of the

upper lemma. *Lower floret* neuter; lemma membranous, equalling the spikelet in size and shape, hyaline, nerves 5, prominent, dorsal surface more or less covered with thick walled, clavate-tipped short hairs; palea absent. *Upper floret* hermaphrodite; lemma subcoriaceous, brown or black, longitudinally striolate, elliptic-oblong, sub-acute; margins overlapping; palea of the same texture and shape as the lemma; margins overlapping below.

Can be easily distinguished from *D. longiflora* by the mealy pubescence on the lower lemma and on the upper glume if present.

KHASI, NAGA & LUSHAI HILLS.

**10. *Digitaria longiflora* Pers. Syn. l. (1805) 85
Syn. *Paspalum longiflorum* Retz. Obs. IV (1786) 15 (non
Trin.).**

Annual. *Culms* often creeping extensively and sending up erect shoots from the nodes; flowering branches erect, slender. *Leaf-blades* lanceolate to linear, acute, 1-6 cm. long by 2-4 mm. wide, spreading, flat, soft, glabrous or with a few hairs; sheaths rather tight, glabrous or rarely the lower more or less hairy and sparingly bearded at the nodes; ligule short, truncate, membranous.

Inflorescence of 2-3 racemes, rarely more, which are sessile, digitate, slender, 2.5-7.5 cm. long, erect or spreading, pale-green in flower; rhachis flat, straight; margins scabrid; pedicels 2-3-nate, terete with discoid tips, the longer up to 2 mm. long. *Spikelets* appressed, sub-imbricate, elliptic-oblong, acute, 1.3-1.5 mm. long, pale-green or whitish owing to fine appressed pubescence. *Lower glume* absent, upper delicate, broad oblong, sub-obtuse or sub-acute, as long as or almost as long as the spikelet, 5-3-nerved, with dense lines of appressed hairs between the nerves and along the margin. *Lower floret*; lemma hyaline, shape and size of spikelet, 7-nerved, with rows of appressed pubescence between the nerves; palea and lodicules microscopic. *Upper floret*; lemma equalling the spikelet, shortly acute or sub-apiculate, slate-colour to olive-green when ripe, thinly chartaceous, margin overlapping; palea of the same sub-

stance as the lemma. *Anthers* .5 mm. long. *Caryopsis* ellipsoid, slightly compressed, .8 mm. long.

Very common up to 2,000 ft.

5. ALLOTEROPSIS Presl, emend. Hitch.

Spikelets ovate or elliptic to lanceolate-oblong acute or acuminate, mostly awned, slightly or conspicuously compressed from the back, falling entire from the pedicels, 2-nate or fascicled, sub-second and abaxial on the triquetrous rhachis of more or less spiciform, digitate or sub-digitate racemes; lower floret usually male; upper floret hermaphrodite. *Glumes* unequal, lower smaller, membranous to hyaline 3-1-nerved, very acute often mucronulate; upper equal or sub-equal to the spikelet, membranous to chartaceous, 5-nerved with the outer nerves submarginal, densely ciliate along them. *Lower floret*; lemma resembling the upper glume, but ciliate, the tips minutely truncate, and the lateral nerves approximate to each other and in or near the marginal flexure; palea short, deeply 2-fid with conspicuously auricled flaps. *Upper floret*; lemma chartaceous, glabrous, delicately ciliolate upwards, 5-nerved, produced into a straight awn or mucronate; palea equal to the lemma, 2-keeled with broadly auricled flaps. *Lodicules* 2, broadly cuneate. *Stamens* 3. *Styles* distinct; stigmas laterally exserted. *Caryopsis* enclosed by the lemma and palea, elliptic-oblong, dorsally much compressed; hilum basal, punctiform.

Perennials or annuals; leaf-blades flat or more or less convolute; ligule membranous, ciliate or ciliolate, short or reduced to a rim; racemes sessile or peduncled, often more or less compound towards the base, digitate or sub-digitate or a more or less elongated common axis.

Key to the species of *Alloteropsis*.

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|-------------------------------------------------------------------------------------------------------------------------|--------------------------|
| False spikes sub-digitate, 2-5; spikelets 6 mm. long; lemma of the upper floret long aristate. | 1. <i>A. semialata</i> . |
| False spikes sub-vorticillate, 3-8; spikelets 3-4 mm. long; lemma of the upper floret abruptly and shortly aristate. .. | 2. <i>A. cimicina</i> . |

1. Alloteropsis semialata Hitch., Contrib. U. S. Nat. Herb. XII (1909) 210. Syn. *Axonopus semialatus* Hook. f. F. B. I. VII (1897) 64.

Perennial. *Culms* 30-40 cm. tall, erect, densely tufted, thickened at the base, covered with the silky debris of old sheaths, lower internodes short, nodes velvety. *Leaf-blades* 20-30 cm. long by 4-6 mm. wide, narrowly linear, very narrow at the base, straight, acuminate, stiff, the majority at the base, glabrous or pubescent, margins almost smooth, sometimes carrying a few long hairs with tubercled bases; sheaths hairy; margins ciliate, ligules obscure hairy.

Inflorescence made up of 2-5 false spikes, subdigitate or subverticillate, erect or scarcely divergent, 6-15 cm. long, on a long, straight peduncle more or less hairy; rachis rather robust, straight, more or less pubescent, often with spikelets to the base. *Spikelets* sessile or sub-sessile, pale orange brown, 6 mm. long; lower glume with 3 strong nerves, ovate-acute, acuminate, aristulate more or less, with ciliate margins; upper glume 5.5 mm. long, broadly ovate-lanceolate, acute or acuminate, shortly aristate, with large, pale or dark hairs on the margins, 5-nerved. *Lower floret* male, lemma 6 mm. long, rather more rigid than the glume although thin, ovate-lanceolate, acuminate, with inturned margins, ciliate; palea much reduced. *Upper floret* hermaphrodite; lemma 6 mm. long, more rigid but hardly thicker, oblong-lanceolate, acuminate, margins narrowly incurved, pubescent, ending in a scabrid cusp exceeding the very stout crest of the upper glume; palea rather rigid, ovate-elliptic; margins inflexed, thin, with a distinct lobe at the base on either side. *Anthers* 3-3.5 mm. long.

Common in the KHASI HILLS 4,500 ft. being found at Mawphlang, Sweet Falls, Nartiang and elsewhere.

2. Alloteropsis cimicina Stapf, in Flor. Trop. Afr. IX. 487. Syn. *Axonopus cimicinus* Beauv. Ess. Agrost. (1812) 12.

Perennial. *Culms* 30-60 m. high, tufted, erect or decumbent and geniculate at the base, glabrous or hairy, nodes hirsute. *Leaf-blades* flat, 2.5-7.5 cm. long, by 1.25-2.5

cm. wide, ovate or ovate-lanceolate, sharp, base cordate and broad, hirsute, rarely glabrescent, long white hairs on both surfaces spreading, margins ciliate with long white hairs, rather distant at the base and few tubercle bases; sheaths glabrous or hirsute; ligule reduced, hairy.

Inflorescence made up of 3-8 false spikes, sub-verticillate, 7.5-15 cm. long, rarely longer, at the top of a long glabrous peduncle; rhachis filiform, flexuous, simple or branched, slightly scabrous, naked at the base; pedicel sometimes equal in length to the spikelet, swollen at the top, glabrous. *Spikelets* pale, rather shining, ovoid, dorsally compressed, 1-2-nate, laxly imbricate or distant. *Lower glume* 1.6-2.6 mm. long, ovate-lanceolate, acuminate, 3-5-nerved, nerves green, the lateral joining the median below the summit; margins membranous; upper glume 2.5-4 mm. long, membranous, ovate-lanceolate, mucronate or slightly aristate, long velvety on the margins. *Lower floret* male; lemma 2.5-4 mm. long, ovate-obtuse; palea very much reduced. *Upper floret* hermaphrodite; lemma 2.5-3 mm. long, smooth, ovate-oblong, abruptly aristate, glabrous, margins narrowly incurved, obscurely 3-nerved, produced into a setiform awn, palea ovate-elliptic, subcoriaceous. *Anthers* .5-1 mm. long. *Caryopsis* ovate, flattened.

Fairly common in the plains.

6. SACCOLEPIS Nash.

Spikelets oblong to ovate-oblong or elliptic or lanceolate, subterete or laterally compressed, frequently more or less oblique (seen in profile), usually somewhat turgid, falling entire from the short, finely filiform pedicels of a spiciform panicle; lower floret male or barren; upper hermaphrodite. *Glumes* similar in structure but unequal, the lower being much shorter softly or rigidly membranous, with a narrow hyaline margin or hyaline tip, stiffened by the hardening of the prominent and often rib-like nerves, or more or less dissimilar owing to the reduction of the lower glume to a small hyaline scale, or its differentiation into a narrow, hardened, obscurely nerved back and broad hyaline margins; upper glume with a curved or basally gibbous or saccate back, always much concave, mostly 7- or 9- rare 5- or up

to 13-nerved. *Lower floret*; lemma similar to the upper glume and of the same or almost the same length but with a straight back; palea narrow, hyaline, finely 2-keeled, shorter than the lemma, sometimes much more reduced or quite rudimentary. *Upper floret*; lemma oblong in outline when seen from the back, very convex, chartaceous, ultimately subcrustaceous, with firm narrowly involute margins, obscurely 5-nerved; palea almost as long as the lemma, lightly embraced by it all long and of the same texture, 2-nerved, hardly keeled. *Lodicules* 2, small, broadly cuneate. *Stamens* 3. *Style* distinct. *Stigmas* long, loosely plumose, exserted terminally or subterminally. *Caryopsis* tightly enclosed by the somewhat hardened palea and lemma, elliptic in outline, dorsally compressed, with an almost flat back and convex face; hilum punctiform; embryo more or less half the length of the grain.

The correct spelling of the name of the genus is *Saccolepis*, as invented by Nash himself; there does not seem to be any reason why later botanists should spell the name *Sacciolepis*.

Key to the species of *Saccolepis*.

Spikelets acute.

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|-------------------------------------------|----------------------------|
| Spikelets 4-5 mm. long. | 1. <i>S. interrupta</i> . |
| Spikelets 2·5-3·5 mm. long. | 2. <i>S. indica</i> . |
| Spikelets obtuse, 1·5-2 mm. long. | 3. <i>S. myosuroides</i> . |

1. Saccolepis interrupta Stapf in Prain Flor. Trop. Afr. IX. 757. *Panicum interruptum* Willd. Sp. Pl. I (1797) 341.

A large perennial grass, quite glabrous; culms up to 1·5-1·8 m. long, ascending from a stout creeping and rooting or floating rootstock; lower nodes emitting fascicles of long, stout roots clothed with root hairs; upper internodes very long, slender. *Leaf-blades* 15-30 cm. long, by 6-13 mm. wide, linear, finely acuminate, soft flat glabrous, with smooth or scaberulous margins, base rounded or subcordate, sheaths 5-10 cm. long, with smooth margins; ligule short, broad, membranous.

Inflorescence a spikelike panicle, 15-30 cm. long by 6-8 mm. wide, cylindric, interrupted below; rhachis short,

strict, channelled. *Spikelets* 4-5 mm. long, densely crowded in small fascicles, sub-sessile or shortly pedicellate, spreading, ovoid-lanceolate, acute, green. *Lower glume* scarcely 1·6 mm. long, broadly ovate, obtuse, hyaline, 3-5-nerved. *Upper glume* ovate, acute, herbaceous, membranous, prominently 9-nerved. *Lower floret* male or barren; lemma equaling the upper glume in length, ovate, acute, 7-nerved; palea hyaline. *Upper floret* hermaphrodite; lemma shorter than the lemma of the lower floret, ovate-oblong, subacute, thinly coriaceous, white, polished, dorsally convex, palea thinly coriaceous as long as the glume. *Anthers* purple, much exserted. *Caryopsis* obovoid, apiculate.

A good fodder grass for stock and very much relished by elephants. Very common in marshes and bils in the plains.

2. *Saccolepis indica* A. Chase in Proc. Biol. Soc. Wash. (1908) 8. *Syn. Panicum indicum* Linn. Mant. II (1771) 184.

A tufted annual. *Culms* 1·8 m., ascending or erect, branched, striate, slender, compressed and with a leafy base, glabrous, cylindrical, bare at the top. *Internodes* long. *Leaf-blades*, soft, spreading, linear-acuminate, base narrow or rounded, flat, 3-10 cm. long, 2·5-4·5 mm. broad, glabrous or hairy below, margins scabrid, nerves numerous; sheaths open, somewhat lax, compressed, sub-keeled at the top, the lower short, glabrous with glabrous margins; ligule short, obtuse, shortly fimbriate at the summit.

Inflorescence a narrow panicle, erect, spiciform, dense, rarely interrupted, 1·25-7 cm. long; rhachis slender, glabrous; branches simple, numerous, short, appressed and sometimes adnate to the axis; pedicel glabrous, short, swollen at the tip. *Spikelets* densely crowded, erect or spreading, longer than the pedicels, olive-green, sometimes purplish, or bluish, ovoid-acute, more or less gibbous and decurved, sub-compressed, glabrous or often hispid, 2·5-4 mm. long. *Lower glume* 5-1·5 mm. long, membranous, clasping, ovate-acute, strongly 3-5-nerved, margins hyaline; upper glume 1·5-4 mm. long, membranous-herbaceous, ovate-obtuse, subacute, cymbiform, rather gibbous, strongly 7-11-nerved, often

ciliate with stiff silk, swollen at the base. *Lower floret* male, lemma 1·5-4 mm., herbaceous, membranous, ovate-obtuse, not gibbous, strongly 7-9-nerved, sometimes ciliate; palea small, hyaline. *Upper floret* hermaphrodite; lemma 1·3-3·7 mm. long, whitish, oblong, or ovate, sub-acute, acute or acuminate, mucronulate, convex on the back, smooth, sub-coriaceous, shining, with margins strongly clasping; palea ovate-oblong rather obtuse, smooth, shining with margins strongly inflexed. *Stigmas* violet. *Caryopsis* oblong.

Common all over the province, particularly so in the hills.

3. Saccolepis myosuroides A. Camus in Lecomte, Flor. Gén. de l' Indo-Chine VII. 460. Syn. *Panicum myosuroides* R. Br. Prod. (1810) 189.

Culms 40-60 cm. tall, erect or slightly decumbent at the base, striate, slender or robust, bare at the summit, inferior node more or less geniculate, glabrous. *Leaves* narrowly linear, finely acuminate, with a narrow base with long woolly hairs, scabrid above, 15-20 cm. long, 2·5-6 mm. wide, many-nerved, slender, the median most prominent, margins scarcely scabrid; sheaths glabrous, striate; ligule practically absent.

Inflorescence a narrow panicle, erect often somewhat curved, cylindrical, spiciform, dense, 10-20 cm. long; rachis slender, furrowed; lemmas very short, appressed, adnate to the axis. *Pedicel* very short, swollen at the tip. *Spikelets* narrowly crowded in little fascicles, erect, longer than the pedicels, olive-green, rather darker at the tip, sub-glabrous, smooth, 1·5 mm. long, obtuse at the tip; lower glume 3-1 mm. long, membranous or somewhat herbaceous, clasping, convex, strongly 3-nerved; upper glume 1·5 mm. long, convex, ovate-oblong, obtuse, 5-9-nerved. *Lower floret*; lemma 7-1·4 mm., membranous, herbaceous, ovate-obtuse, broader than the upper glume, very convex, 9-nerved; palea small, hyaline. *Upper floret* hermaphrodite; lemma 4·9 mm., white, smooth, shining, sub-coriaceous, ovate-oblong, acute, convex on the back with involute margins.

Common in the hills.

7. HYMENACHNE Beauv.

Spikelets short-pedicelled, crowded in slender racemes which are erect, forming a close spikelike panicle, or narrowly ascending; spikelets narrowly lanceolate, acuminate, lower glume cuspidate, keeled, $\frac{1}{3}$ to $\frac{1}{2}$ as long as the spikelet, remote, a distinct stipe below the upper glume which is sheathing, 3-nerved cuspidate; lower floret barren; lemma 5-nerved, acuminate or cuspidate; upper floret hermaphrodite; lemma and palea membranous, margins of the lemma thin, not enrolled; palea not enclosed at the tip; grain oblong, tip contracted at maturity readily falling from the open lemma and palea.

Perennial aquatic or semi-aquatic grasses, decumbent at the base and rooting at the lower nodes, with rather short simple stems and long lanceolate blades, cordate, clasping at the base.

Tropics and sub-tropics.

Key to the species of *Hymenachne*.

Spikelets 4-6 mm. long.	..	1. <i>H. amplexicaulis</i> .
Spikelets up to 3 mm. long.	..	2. <i>H. assamica</i> .

1. *Hymenachne amplexicaulis* (Rudge) Nees, Agrost. Bras. (1829) 276. Syn. *Panicum amplexicaule* Rudge, Pl. Guian. I (1805) 21. (*Panicum myurus* H. B. K. of F. B. I.).

Short erect herbs from a creeping rootstock, spongy below, rooting at the lower nodes; culms erect, 6-2 m. high, striate, channelled, glabrous and smooth, nodes glabrous. Leaf-blades linear, tapering to a very fine point, 9-45 cm. long, up to 2 cm. broad, base rounded or cordate, smooth and glabrous, many nerved, margin thickened and minutely serrulate, teeth distant; sheaths very loose, smooth, glabrous, striate; margins ciliate; ligule a narrow membranous ring.

Inflorescence a thyrsoid panicle, up to 30 cm. long by 2.5 cm. broad, with erect, appressed branches; branches spiciform; rachis stout, channelled and angled; branches also stout, very closely appressed; pedicels very short. *Spikelets* narrowly lanceolate-acuminate, up to 5 mm. long.

Glumes membranous; lower 2.5 mm. long, 1-nerved, keeled, cuspidate, scaberulous; upper glume 4.5 mm. long, 5-nerved, sheathing the rhachilla, cuspidate or curved, 3-ribbed, scaberulous. *Lower floret* barren; lemma 4.5-5 mm. long, lanceolate, membranous, 5-nerved tapering to an arista; palea 1/3 as long; upper floret hermaphrodite; lemma ovate-obtuse, 3.2-3.5 mm. long, membranous at flowering time, dull white, 2-nerved, hardening at maturity, embracing the palea except at the tip; palea same shape and texture. *Lodicules* 2. *Stamens* 3, 1 mm. long. *Styles* 2, free. *Caryopsis* very small, oblong, top contracted. *Embryo* large, orbicular.

Common in wet places in the plains.

2. *Hymenachne assamica* Hitch. in Lingnan Sci. Journ. Vol. VII. (1929) 222. Syn. *Panicum assamicum* Hook. f. F. B. I. VII (1897) 40.

A slender grass ascending from a geniculate base, lower nodes rooting. *Culms* up to 45 cm. long, smooth and glabrous. *Leaves* lanceolate, acuminate, 5-10 cm. long, 3-5 mm. wide, finely nerved, sparsely hairy below, margins scarcely thicker, often ciliate on the rounded or subcordate base; sheaths rather loose, shorter than the internodes, smooth striate, margins ciliate, ligule a narrow membrane.

Inflorescence a spiciform panicle, cylindric, interrupted, 5 cm. long by 7 mm. broad; rhachis moderately stout, angled, scaberulous; branchlets short, closely appressed; pedicels stout, scaberulous. *Spikelets* narrowly ovate-acute, 3 mm. long. *Lower glume* orbicular, subapiculate, 3-nerved, clasping, 1.5 mm. long, hyaline, smooth and glabrous or very slightly scaberulous on the nerves; upper glume 1.5 mm. long, ovate-acute, strongly five-nerved, smooth and glabrous. *Lower floret* barren; lemma 2.75 mm. long, oblong-obtuse, subacute, 5-nerved, epaleate. *Upper floret* hermaphrodite; ovate-acute, faintly 3-nerved, thin, membranous, 2.5 mm. long; palea of the same shape and texture as the lemma, margins hyaline, incurved. *Stamens* 3, .75 mm. long. *Styles* 2. *Stigmas* plumose.

Common in wet places in the plains.

8. ICHNANTHUS Beauv.

Spikelets on short pedicels, 2-flowered, ovate-lanceolate, rounded or compressed laterally, articulate, but often persistent on the pedicels; glumes 2, membranous, often spreading, strongly nerved, sub-equal. *Lower floret* male or barren, lemma resembling the upper glume; palea often short. *Upper floret* caducous, hermaphrodite, much smaller, plane at right angles to the plane of the glumes, coriaceous, smooth, oblong or oblong-lanceolate, stipitate, with flattened rhachilla, with 2 lateral appendages or scars, symmetrical, falciform or auriculate, often adnate to lower lemma; palea oblong. *Lodicules* 2. *Stamens* 3. *Ovary* with 2 styles free at the base; stigmas feathery, exserted at the summit of the floret. *Caryopsis* coriaceous, oblong, acute or acuminate, enclosed in the lemma which is often hardened.

Annual or perennial. *Culms* branching and rooting at the base. *Leaf-blades* broad or narrow. *Inflorescence* an elongated panicle, more or less branched.

Key to the species of *Ichnanthus*.

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|-----------------------------------------------------------------------------|----------|---------------------------|
| Stems 30-60 cm. long, decumbent; leaves broadly lanceolate, amplexicaul. | | 1. <i>I. vicinus</i> . |
| Stems tufted, dwarf, 15-20 cm. long, hispid; leaves short, almost subulate. | .. .. .. | 2. <i>I. foliolosus</i> . |

1. ***Ichnanthus vicinus* (F. M. Bail.) Merr.** in Enum. Philip. Fl. Plants I (1923) 70. Syn. *I. pallens* Munro in Benth. Fl. Hongk. (1861) 414.

Perennial. *Culms* 30-60 cm. high, weak, decumbent at the base, often branched, more or less pubescent, with numerous nodes, close, the lower rooting, and often geniculate. *Leaf-blades* spreading, thin, flat, oblong-lanceolate, attenuate, acuminate; base amplexicaul, rounded or obliquely cordate, 7.5-15 cm. long, 1.25-2.5 cm. broad, scaberulous above, with closely appressed hairs below, nerves fine, the median scarcely stronger, margins hispid; sheaths lax, split, margins ciliate, striate, more or less pubescent; ligule obscure, hairy.

Inflorescence a sub-pyramidal panicle, emerging from the sheath of the uppermost leaf, often 1-sided, 6-22 cm. long, erect or nodding; rachis angular, erect, glabrous; branches

erect or drooping, completely hispid or with white wool at the base, the lower spaced; pedicels shorter than the spikelets, asperulous. *Spikelets* lanceolate, acuminate, green, often more or less hairy, 4-5 mm. long; glumes spreading, herbaceous-membranous, the lower 2·5-3·3 mm. long, ovate-oblong, lanceolate, acuminate, sub-aristate, 3-5-nerved, often hispid, scabrous hispid at the summit of the keel; upper glume, 4-5 mm. long, acuminata, 5-7-nerved, often hispid, scabrous-hispid and with a few cilia on the keel. *Lower floret* barren or male; lemma 3·3-3·8 mm. long, oblong-lanceolate, acute or obtuse, consistency of the glumes, 5-nerved, keel scaberulous; palea 2·5-3·4 mm. long, oblong-obtuse, membranous, shortly ciliate on the keels, 2-nerved. *Upper floret* hermaphrodite, stipitate, at first in the same plane as the glumes, turned through 90° at maturity, caducous, stipes turbinate, not winged; lemma 2·2-3·4 mm. long, coriaceous, smooth; palea 2·2-3·4 mm. long, oblong-obtuse, margins scarcely inflexed, lodicules collateral, linear quadrangular. *Anthers* linear. *Ovary* elliptic.

Very common up to 5,000 ft.

2. Ichnanthus foliolosus Munro ex Hook. f. F. B. I.
VII (1897) 61.

A dwarf annual. *Culms* fastigiately branched from the base, densely tufted, prostrate with tips erect or ascending, 15-20 cm. high, nodes hispidly hairy. *Leaf-blades* lanceolate, 3-4 mm. wide, 5 cm. long, often densely crowded, ascending or spreading, flat, rather rigid, tip blunt, margins hispidly ciliate, many-nerved and also tessellately nerved, base rounded, both surfaces covered with hispid hairs; sheaths short, striate hispid; ligule a rim of stiff, rigid hairs.

Inflorescence a sparingly branched panicle half immersed in the sheath of the uppermost leaf; branches ascending. *Spikelets* crowded on the scabrid or hispid branchlets, 4 mm. long, ovate-acuminate in profile; pedicels cupped, angled, scabrid, very short or twice the length of the spikelet, cupped at the tip. *Lower glume* 4·5 mm. long, lanceolate, 5-nerved, sometimes 2 faint nerves at the margins, keeled towards apex, where the median nerve is flattened and continued into a short

arista which is ciliate on the back; upper glume 4·5-5 mm. long, 7-nerved, similar in shape but not ciliate, membranous. Lower floret barren, epaleate; lemma same texture as the glume, 7-nerved, 4·5 mm. long. Upper floret hermaphrodite; lemma ovate, sub-acute, on a stipe provided with a two-lobed appendage, scars obscure, 2·3 mm. long, coriaceous, pale-yellow or whitish, not turned on the stipe though 90° as in *I. vicinus*, margins hyaline clasping the palea; palea same texture as lemma, ovate-obtuse, margins hyaline inflexed. Anthers linear 1 mm. long.

Will probably be found in the NAGA & LUSHAI HILLS.

9. PANICUM Linn.

Spikelets lanceolate to oblong, elliptic or orbicular in outline, symmetrical in profile, rarely somewhat oblique, falling entire, or almost so, from the often elongated pedicels of a decompound panicle, without a definite orientation towards the axis; lower floret male or barren, usually with a distinct palea, sometimes the latter absent; upper floret hermaphrodite. Glumes more or less herbaceous-membranous; the lower usually shorter than the upper (often by very much) rarely equalling it, usually with one or more nerves, or if very small, nerveless; upper as long as the spikelet, rounded on the back, 5-9-nerved. Lower floret; lemma very similar to the upper glume equally rounded and curved on the back (rarely less when the spikelets become oblique), 5- to 9-, rarely 3- or 11- nerved. Palea thinly membranous to sub-hyaline, sub-equal to the lemma, or more or less reduced, rarely suppressed. Upper floret; lemma sub-coriaceous to coriaceous with firm margins, obtuse to sub-acute, faintly nerved; palea sub-equal to the lemma and of similar substance, tightly embraced by the more or less involute margins of the lemma. Lodicules 2, broadly cuneate. Styles distinct; stigmas laterally exerted near the tip of the floret. Grain tightly enclosed by the hardened lemma and palea, dorsally compressed, biconvex to almost plano-convex; scutellum elliptic to ovate-elliptic, almost half as long as the grain; hilum sub-basal, punctiform.

Perennials or annuals rarely suffrutescent, of varying

habit and size; leaf-blades mostly linear to linear-lanceolate, but in some groups ovate or filiform or subulate; panicles usually much divided and at least temporarily open; spikelets usually loosely scattered, glabrous or hairy.

Key to the species of *Panicum*.

Leaf-blades linear to narrowly lanceolate, spikelets symmetrical.

Lemma of the upper floret finely transversely rugose. 1. *P. maximum*.

Lemma of the upper floret quite smooth.

Spikelets 4-5 mm. long; sharply acute, ovate to elliptic in back view.

Leaf sheaths hairy; spikelets persistent; panicle contracted. 2. *P. miliaceum*.

Leaf sheaths glabrous; spikelets deciduous; panicle effuse; pedicels longer than spikelets. 3. *P. incisum*.

Spikelets up to 3 mm. long, rarely to 4 mm. if so, with narrow lanceolate spikelets.

Spikelets 1.5 mm. long.

Dwarf grass; leaves narrow from a narrow base; upper glume 3-nerved; lower floret paleate. 4. *P. humile*.

Tall slender; leaves linear from a narrow cordate base; upper glume 5-nerved; lower floret epaleate. 5. *P. humidorum*.

Spikelets over 1.5 mm. long.

Lower glumes cuspidate-acuminate. 6. *P. trypheron*.

Lower glumes not cuspidate-acuminate.

Spikelets narrowly lanceolate to lanceolate-oblong, acute.

Lower glume orbicular, rotundate, or truncate, 1/6-1/4 length of spikelet; spikelets 2.5-4 mm. long; panicle branches loose to closely spiculate.

Spikelets long narrowly lanceolate; leaf-blades broad, flat; culms spongy floating. 7. *P. paludosum*.

Spikelets lanceolate to lanceolate-oblong; leaf-blades narrow often involute; culms tough, rhizomatous. 8. *P. repens*.

Lower glume ovate, acute or obtuse,
1/3 the length of the spikelet 3-5
nerved; spikelets 3 mm. long;
panicle branches densely spiculate. 9. *P. auritum*.
Spikelets oblong, ovate-oblong, to
elliptic, acute or obtuse.

Lower glume $\frac{1}{4}$ - $\frac{1}{2}$ the length of
the spikelet:—

Nodes and leaf-sheaths hairy;
annual; transverse nerves in
glumes; spikelets shortly pedi-
cled or sub-sessile. .. 10. *P. cruciabile*.

Nodes and leaf-sheaths glab-
rous:—

Annual; culms erect or geni-
culate; leaf blades linear;
lower floret with a palea:—

Spikelets persistent; panicle
contracted; spikelets 2-3.5
mm. long. .. 11. *P. miliare*.

Spikelets deciduous; panicle
effuse; spikelets 2-3 mm.
long. .. 12. *P. psilopodium*.

Perennial; culms ascending
from a creeping base and
rooting at the nodes; leaf-
blades narrowly lanceolate,
somewhat cordate; lower
floret epaleate; upper glume
persistent. .. 13. *P. khasianum*.

Lower glume $\frac{1}{2}$ - $\frac{3}{4}$ length of the
spikelet:—

Spikelets obtuse; perennials:—

Spikelets 2-2.5 mm. long;
leaf-blades broad:—

Lower floret epaleate; leaf
margins pectinately ciliate;
upper glume fugacious. .. 14. *P. montanum*.

Lower floret paleate. .. 15. *P. sarmentosum*.
Spikelets acute. .. 16. *P. acroanthum*.

Leaf-blades lanceolate to ovate; base cordate;
spikelets oblique. .. 17. *P. brevifolium*.

1. *Panicum maximum* Jacq. Ic. Pl. Rar. I. 2. tab.

13. Collect. Bot. I (1786) 76.

Perennial, tufted; innovation shoots intravaginal;
rhizome short, sometimes very stout; culms erect or genicu-

late, robust, usually tall, up to 3 m. long, compressed below, glabrous on the lower part, more or less hirsute, usually 3- to 6-noded, sub-simple or more or less branched, branches erect, upper internodes exserted. Leaves glabrous or softly hairy or coarse hirsute with tubercle-based hairs, blades linear to lanceolate linear from a contracted and rounded or attenuate base, long tapering to a fine (sometimes convolute and filiform) point, 30-60 cm. long, 5 mm.-2 cm. broad, rarely broader, flat, minutely tomentose at the junction with the sheath; midrib rather short, whitish; sheaths rather firm, the lower compressed, striate, nodes glabrous, pubescent or bearded; ligules membranous, very short, ciliate and often with a dense beard behind.

Inflorescence a panicle erect or nodding, contracted or effuse and lax, decompound, from 15 to over 30 cm. long; axis slender, angular, glabrous, smooth or scaberulous above; lower branches whorled, sub-erect or spreading, rather distant, up to 15 cm. long, divided almost from the base, or undivided, from 2·5-6 cm., filiform, scaberulous above, smooth below, glabrous except at the often minutely tomentose or pubescent callous base; pedicels fascicled, 3-2-nate or the upper solitary, very unequal, very short to several times longer than the spikelet, capillary, flexuous, scabrid. *Spikelets* oblong, sub-obtuse or obtuse, somewhat turgid, 3·2-3·8 mm. long, light-green, sometimes tinged with purple, glabrous, rarely puberulous; lower glume rounded 8-2·4 mm. long, sub-hyaline, faintly 3-nerved to nerveless; upper oblong, acute or obtuse, 3-3·5 mm. long, membranous, 5-nerved. *Lower floret* male; lemma very similar to and very slightly shorter than the upper glume; palea oblong, obtuse. *Upper floret* hermaphrodite, equaling the lower or scarcely shorter, oblong; obtuse; lemma 5-nerved, finely transversely rugose; anthers 1·25-1·8 mm. long, grain over 1·25 mm. long.

A valuable fodder grass. Introduced from Africa and run wild in some places.

2. *Panicum miliaceum* Linn. Sp. Pl. (1753) 58.

An annual herb with fibrous roots, culms 5-1·2 m. tall, procumbent at the base, tufted, stout, round, sub-angular or

compressed, pubescent at the base and on the nodes, leafy to the panicle. *Leaf-blades* linear, acuminated, slightly rounded at the base, truncate or rarely cordate, flat, soft or hispid, 30-50 cm. long, 1-2.5 cm. broad, margins slightly scaberulous with a few long cilia with swollen bases, principal nerves 9-11, the median the most distinct; sheaths split, lax, sub-compressed, striate, hairy with tubercle-based hairs; ligules hairy.

Inflorescence thyrsiform, often decurved, sometimes very dense in cultivated states, 15-40 cm. long; rhachis scarcely thicker than the branches and like them angular, scabrid or hispid; branches long, sub-erect, bare at the base, divided at the summit; pedicels capillary, longer or shorter than the spikelets. *Spikelets* green or ovate-acute, turgid, glabrous, 4-5 mm. long. *Lower glume* 2.3-2 mm. long, convex, clasping, broadly ovate-acute or acuminate, strongly 5-7-nerved; upper glume 4-5 mm. long, broadly ovate-acuminate, cuspidate, very convex 7-11-nerved. *Lower floret* barren, lemma 3.7-4.7 mm. long, like the upper glume; palea reduced or absent, narrow, thin, conduplicate, with two delicate nerves. *Upper floret* hermaphrodite, sessile; lemma 3.5-4.5 mm. long, smooth, shining, crustaceous, yellow or brownish, ovate, attenuate at the apex, with inflexed margins, palea 3.5-4.5 mm. long, of the same texture as the lemma, convex, with margins inflexed. *Ovary* with very short styles; stigma purple. *Anthers* linear. *Caryopsis* almost orbicular, plano-convex, white.

Run wild in the plains.

3. *Panicum incisum* Munro ex Clarke in Jour. Linn. Soc. XXV (1890) 84, tab. 33.

Perennial. *Culms* 30-60 cm. tall, extensively creeping at the base, finally erect, quite glabrous, short noded, leafy to the top. *Leaf-blades* long, linear-lanceolate from a contracted base, finely acuminate, rather rigid, many-nerved, both surfaces smooth and glabrous, margin scarcely thickened, scaberulous, occasionally a few cilia near the narrowed base; sheath glabrous, smooth, striate, overlapping; ligule elongate-oblong, lacerate, scarious.

Inflorescence issuing from the uppermost leaf sheath, very effuse, lax; principal axis short, angled, scaberulous; branchlets long, capillary, scaberulous, sparingly divided; branchlets capillary, scaberulous; pedicels much longer than the spikelets, swollen at the tip to form a minute cup. *Spikelets* up to 4·5 mm. long, remote, solitary, elliptic-acuminate in profile. *Glumes* distant on a stout, inarticulate rachilla; lower glume broadly ovate-elliptic, acute, 3-4-nerved, herbaceous, 2·5 mm. long; upper glume ovate-acuminate, clasping, membranous, 5-nerved, 4·25 mm. long; lower floret male; lemma membranous, 4 mm. long, 7-nerved; palea small, 1 mm. long; upper floret hermaphrodite; lemma 3 mm. long, smooth, subcoriaceous, brown, broadly ovate-acute or acuminate, longitudinally obscurely striate, margins narrowly inflexed; palea narrowly ovate-oblong, 2-keeled margins inflexed, 2·5 mm. long of the same texture as the lemma.

Very common in Upper Assam in clearings in the forest.

4. **Panicum humile** Nees ex Steud. Syn. Pl. Glum. (1854) 84.

Annual, tufted. 15-45 cm. high, sometimes quite dwarf. *Culms* erect or geniculate, slender, glabrous and very smooth, often purplish, branched from all or most nodes, with the branches often fascicled and very unequal. *Leaf-blades* linear from a slightly rounded base, tapering to a slender point, 2-15 cm. long, 3-5 mm. broad, flat, flaccid, quite glabrous, slightly scaberulous along the margins, midrib distinct, lateral nerves (about 3 on each side) fine or slightly prominent below, less so or hardly at all above; sheaths somewhat loose, often hirsute, striate, glabrous except at the upper margins which are sometimes delicately ciliate; ligule a minute, ciliolate rim.

Panicle open and very loose, up to 10 cm. long by 5 cm. broad, quite glabrous; branches and branchlets very slender, sub-rigid, scaberulous upwards; pedicels slightly thickened at the tips: in dwarf specimens the panicle much smaller or contracted. *Spikelets* 1·5 mm. long, acutely acuminate when closed, then more or less, but never widely gaping, greenish or more often tinged with purple. *Lower glume* obliquely

lanceolate, acutely acuminate up to 1 mm. long, 3-nerved. *Upper glume* similar but longer, wider, 3- to sub- 5- nerved. *Lower floret* barren; lemma similar to the upper glume but somewhat shorter and paler, 5-nerved; palea distinctly shorter than the lemma, empty. *Upper floret* hermaphrodite. oblong, obtuse, 1·5 mm. long, whitish, glossy and smooth; lemma and palea crustaceous; anthers not quite 1 mm. long. purplish.

Common in the plains.

5. *Panicum humidorum* Ham. (in Wall. Cat. n. 8721.)

A perennial grass, often gregarious in water. *The culms* procumbent and creeping below, rooting at the nodes, finally erect, tall, slender, up to 2 m. tall; culms and nodes smooth and glabrous. *Leaf-blades* flat linear, smooth and glabrous, sometimes slightly scaberulous, margins minutely scabrid, from a narrow cordate base; sheaths smooth and glabrous, striate; ligule a very narrow membrane, erose or lacerate at the top.

Inflorescence a panicle, contracted or effuse; rachis-branches and branchlets capillary, scabrous, angled. *Spikelets* very small, 2 mm. long or sometimes only 1·5 mm., often purple. *Lower glume* 1 mm. long, 3 nerved, ovate-lanceolate, obtuse. *Upper glume* 1·5 m. long, lanceolate, obscurely 5-nerved. *Lower floret*; lemma 5-nerved, 1·5 mm. long, epaleate. *Upper floret* hermaphrodite; lemma ovate, 1·25 mm. long, chartaceous, smooth; palea almost as long and enclosed by the lemma.

Common in marshy land.

6. *Panicum trypheron* Schult. Mant. II (1824) 244.

An annual. *Culms* 15-90 cm. tall, tufted, erect or geniculate at the base, leafy, at the base principally, stout or slender, with glabrous nodes, rarely rooting. *Leaf-blades* sub-erect, narrow, linear, acuminate, base narrow, often flat, softly hairy or hirsute, at least on the lower surface, 7-25 cm.

long, 4-6 mm. broad, margins almost smooth; sheaths glabrous or hairy; ligule short, fimbriate.

Inflorescence a panicle, erect or nodding, broadly oblong, very effuse, very lax, 10-25 cm. long, often as broad; rhachis slender, scaberulous; branches very long, rigid, filiform, scaberulous, divaricate, flexuous, bearing few spikelets, the lower fasciculate. *Pedicels* scaberulous, capillary, often villosus, swollen at the tip 2·5-4 mm. long. *Spikelets* very distant, cvoid, acuminate, glabrous, green, yellow or purple, 2·5-3·3 mm. long, glumes strongly nerved. *Lower glume* 1·6-2·5 mm. long, broadly ovate, cuspidate, finely acuminate, 5-nerved. *Upper glume* 2·5-3·5 mm. broadly ovate, revolved, sub-cuspidate, 7-9-nerved. *Lower floret* barren; lemma 2·3-3·3 mm. long, concave, broadly ovate, sub-cuspidate, 7-nerved; palea white, hyaline, linear-oblong or oblong-elliptic-obtuse. *Upper floret* sessile, lemma 2-3 mm. long, smooth, shining, coriaceous, of variable width, oblong-obtuse or oblong, varying from pure white to greenish-brown, dorsally convex, 3-5-nerved, margins narrowly inflexed; palea of the same texture as the lemma.

Plains of the Lower Assam Valley.

7. *Panicum paludosum* Roxb. Hort. Beng. (1814) 8.

A perennial, base climbing or floating, rooting at the nodes, spongy. *Culms* 60-90 cm. long, erect or ascending, simple or branched, leafy to below the panicle, with glabrous nodes. *Leaf-blades* linear or ensiform, sharp, flat, rounded or sub-cordate at the base, somewhat coriaceous, glabrous, 15-30 cm. long, 6-15 mm. broad, margins scaberulous, many-nerved, fine; sheaths lax, striate, glabrous; ligule reduced to a ring of hairs.

Inflorescence at first contracted then spreading, 10-25 cm. long, often almost as broad; rhachis scarcely distinct from the branches; branches robust, branched at the base, fasciculate below, trigonous, scabrous; pedicels angular, scaberulous, about the length of the spikelet, scarcely inflated at the tip. *Spikelets* almost parallel to the axis, singly or in pairs, ovate-lanceolate, acuminate, green, 3-4 mm. long.

Lower glume 6-8 mm. long, clasping, orbicular or kidney-shaped, hyaline, white, obscurely nerved or nerveless. *Upper glume* 3-4 mm. long, broadly ovate-acuminate, strongly 7-9-nerved. *Lower floret* neuter or male, rarely hermaphrodite; lemma 3-4 mm. long, ovate-lanceolate, acuminate, 9-nerved; palea small or absent, linear oblong, hyaline. *Upper floret* hermaphrodite, sessile; lemma 2.5-3.5 mm. long, smooth, shining, ivory or pale-yellow, somewhat coriaceous, dorsally convex, narrowly oblong-acute or acuminate, margins very broadly involute; palea 2.5-3.5 mm. of the same texture as the lemma, narrowly oblong, with inturned margins and auricled at the base.

In marshes in the plains and up to 4,000 ft. in the hills.

8. *Panicum repens* Linn. Sp. Pl. Ed. 2. (1762) 87.

Perennial. *Rhizome* robust, elongated. *Culms* 5-12 m. long, stoloniferous at the base, erect or ascending, simple or branched at the base, striate, with numerous nodes, glabrous, the lowest rooting. *Leaf-blades* distichous, erect, stiff, rigid, rather coriaceous, linear-lanceolate, acuminate, rounded or cordate at the base, flat or rolled, glaucous, glabrous or hairy on the upper surface, 5-15 cm. long; margins cartilaginous, smooth or tubercled towards the base, many-nerved; nerves fine; sheaths with long ciliate margins principally towards the mouth; ligule a narrow coriaceous ring, hairy.

Inflorescence an erect panicle, often more or less contracted, irregularly branched, 7.5-20 cm. long. *Branches* numerous, erect, very fine, angular, somewhat scabrid, solitary, or 2-3-nate; pedicels short, swollen into a cup at the tip. *Spikelets* erect, solitary or in pairs, ovate-lanceolate, sharp, pale, 2.5-3.5 mm. long. *Lower glume* 5-7 mm. long, membranous, clasping, broad, suborbicular or sometimes sub-acute, nerveless or faintly 3-5-nerved. *Upper glume* 2.5-3.5 mm. long, ovate-acute, convex, membranous, except the tip, 5-7- sometimes 9-nerved. *Lower floret* male or neuter; lemma 2.5-3.5 mm. long, ovate-acute, concave, obscurely 7-9-nerved; palea often 2.2-3 mm. long, membranous, very thin, white, ovate, with inflexed margins; stamens short. *Upper floret*, hermaphrodite, with a short

broad stipe; lemma 2-3 mm. long, smooth, shining, almost white, slightly coriaceous, dorsally convex, ovate-oblong, acute, with broadly inflexed margins, finely 7-nerved; palea 2-3 mm. long, same texture as the lemma, oblong-acute, margins thinly inflexed. *Stamens* long.

Rather rare. Usually found on dry slopes.

9. *Panicum auritum* Presl ex Nees. Agros. Bras. (1829) 116.

A perennial. *Culms* stout up to 2 m. high, erect, soft, smooth and glabrous; nodes glabrous. *Leaf-blades* linear-lanceolate from a cordate base, 20-40 cm. long by 2-4 cm. broad, tapering to a fine point, many nerved, midrib distinct, smooth and glabrous; margins slightly thicker and minutely serrulate; sheaths rather loose, striate, smooth and glabrous, densely ciliate on the margin; ligule a narrow, membranous rim.

Inflorescence a panicle which is usually contracted, 20-45 cm. long; branches somewhat erect; branchlets hairy, numerous, crowded. *Spikelets* seated on scaberulous pedicels which are shorter than the spikelet; rhachis angled, scabrid. *Spikelets* 2·5-3 mm. long, lanceolate in profile. *Lower glume* orbicular, obtuse, clasping the base of the spikelet 1·25 mm. long, 3-nerved. *Upper glume* ovate-lanceolate when flattened, tip acute. 5-nerved, 2·5 to about 3 mm. long. *Lower floret* male, lemma 2·5 mm. long, ovate-lanceolate, tip acute, 5-nerved; palea 1·5 mm. hyaline, oblong, tip acute. *Upper floret* hermaphrodite; lemma white, thinly coriaceous, very faintly 5-nerved; palea similar in texture and shape 1·75 mm. long. *Anthers* 3, 1·75 mm. long.

Very common in the plains.

10. *Panicum cruciabile* Chase in Journ. Arn. Arbor. XX, 3 (1939) 309. Syn. *P. reticulatum* Thw. in Trimen. Jour. Bot. XXIII (1885) 271; *P. caesium* Nees in Hook. Kew Journ. II (1850) 97.

Annual. *Culms* erect from the root, stout, 60 cm.-1 m. tall, densely tufted. *Leaf-blades* linear, 15-25 cm. long,

.6-1.25 cm. broad, tapering to a fine point, sub-cordate, many-nerved, both surfaces more or less covered with white hairs; margin scarcely thickened, minutely toothed with long cilia at the base; sheaths overlapping, loose, striate, compressed, clothed with long, white spreading, deciduous hairs from tubercle bases (even if hairs have fallen the sheaths are still conspicuous from the tubercles which remain); ligule a ridge of hairs.

Inflorescence a large, sub-thyrsiform, erect panicle, 25-45 cm. long, much branched, lower branches long, sub-fascicled; rhachis distinctly angled, stout, scaberulous; branches and branchlets capillary. *Spikelets* sub-sessile, solitary or 2-nate, broadly ovoid, turgid, 2-2.5 mm. long, nerves of the glumes anastomosing, a feature which can be made out with a hand lens. *Lower glume* membranous, 1.5 mm. long, clasping, 5-6-7-nerved, nerves anastomosing. *Upper glume* 2-2.5 mm. long, ovate-acute, finely 7-9- or more-nerved, nerves usually anastomosing. *Lower floret* male; lemma ovate-acute, membranous, 7-9 or more nerved, 2-2.5 mm. long; palea oblong, hyaline, 2 mm. long. *Upper floret* hermaphrodite; lemma 2 mm. long, or less, shining, coriaceous, ovate-acute, pale yellow or brownish, margins narrowly incurved; palea ovate, of the same texture as the lemma, margins sharply incurved.

CACHAR, SYLHET & DARRANG.

For a discussion of the reasons which have led to the rejection of *P. tuberculatum* Thw. and *P. caesium* Nees, see Chase loc. cit.

11. *Panicum miliare* Lamk. Ill. Gen. I. (1791) 173.

An annual. *Culms* .3-1 m. tall, tufted, erect or geniculate at the base, simple or branched, rather slender, glabrous, leafy to just below the panicle. *Leaves* erect, linear, acumin ate, flat, flaccid, rounded and contracted at the base, glabrous or with scattered hairs, 30-50 cm. long, 4-25 mm. broad; margins smooth and very obscurely scaberulous; nerves firm; sheaths loose, ciliate or with a few tubercle-based hairs; ligule very short, truncate, ciliate.

Inflorescence an oblong panicle, decompound, contracted,

erect or nodding, narrower, 5-30 cm. long; rhachis slender, striate, scarcely scaberulous; branches slender, filiform, erect, angular, scaberulous, sparingly branched, the lower extended; pedicels very unequal, reaching 1.5 cm. in length, but are usually short. *Spikelets* solitary or in pairs, subturgid, rather flattened, ellipsoid, or ovate-acute, glabrous, green or purplish, 2.3-5 mm. long. *Lower glume* 7-1.7 mm. long, clasping, broadly ovate, acute or acuminate, 3-5-nerved, the nerves often anastomosing. *Upper glume* 2-3.5 mm. ovate orbicular, sub-acuminate, very concave 11-13-nerved. *Lower floret* neuter; lemma 2.3-5 mm. long, ovate sub-acuminate, 9-nerved; palea 1.7-3.2 mm. long, linear oblong, thin, 2-keeled. *Upper floret* hermaphrodite, sessile; lemma 1.8-3.2 mm. long, shining, smooth, cartilaginous, yellowish or brownish, oblong, acute, or broadly ovate acute, often with 3-5 dorsal striations, dorsally convex with margins broadly inflexed: palea oblong-elliptic, with margins much inflexed.

Naturalised in the plains.

12. *Panicum psilopodium* Trin. Gram. Panic. (1826) 217.

An annual. *Culms* 30-60 cm. long, simple or branched, usually leafy up to the panicle, often tufted, smooth and glabrous. *Leaf-blades* 7.5-30 cm. long, 4-8 mm. broad, flat, linear, tapering to a very sharp point, base rounded, smooth and glabrous; margins cartilaginous; midrib prominent beneath, in young specimens with rather long cilia towards the base; leaf-sheaths rather loose, compressed, smooth glabrous and striate in well-grown and old plants, sparsely hairy in young and depauperate forms; ligule a lacerate membranous ring.

Inflorescence a panicle 5-20 cm. long, branches capillary, angled, scaberulous, lower long naked at the base, finally spreading: pedicels usually longer than the spikelets, swollen into a little cup at the tip. *Spikelets* in pairs or solitary, ovate-lanceolate or ovate-oblong in shape, rarely exceeding 3 mm. in length, glabrous, 2-3 mm. long, rather flattened, often purplish. *Lower glume* orbicular, rotund, apiculate, clasping the base of the spikelet, 1 mm. long,

3-5-nerved, nerves anastomosing, often half the glume hyaline. *Upper glume* length of the spikelet, ovate-oblong or ovate-lanceolate, tip obtuse, 11-nerved, membranous. *Lower floret* barren; lemma as long as the spikelet, same texture as upper glume, 9-nerved; palea narrowly oblong, hyaline, 2-keeled; margin inflexed. *Upper floret* hermaphrodite; lemma oblong-obtuse, apiculate, pale yellow, coriaceous, shining, margins inflexed; palea slightly shorter.

Common in the plains.

13. *Panicum khasianum* Munro ex Hook. J. F. B. I. VII (1897) 54.

A perennial grass. *Stem* prostrate and creeping below, finally erect, reaching 1-2 m. high; nodes smooth and glabrous. *Culms* also somewhat glabrous, striate, polished. *Leaf-blades* lanceolate or linear-lanceolate, tapering to a fine point and joined to the sheath by a cordate base, 15-30 cm. long, 1·8-3 cm. broad, glabrous, hairy, or sub-scabrid, many-nerved; margin slightly thickened and minutely ciliate; sheaths rather loose, striate, hispidly hairy or glabrous, mouth bearded, margins ciliate or not; ligule very narrow, ciliate.

Inflorescence a decomound panicle, 15-30 cm. long and often as broad; rhachis branches and branchlets scabrous; branches up to 15 cm. long. *Spikelets* 2-2·5 mm. long, ellipsoid-subacute, seated on short or long pedicels. *Lower glume* ·75 mm. long, deltoid in outline, obscurely nerved. *Upper glume* as long as the spikelet, membranous, ovate-lanceolate, 3-4-5-nerved, persistent. *Lower floret*; lemma membranous, 5-nerved, epaleate. *Upper floret* hermaphrodite; lemma chartaceous, almost mucronate, pubescent, woolly at the tip, palea of the same texture, almost as long as the lemma and embraced by it. *Anthers* 3, linear.

KHASI & JAINTIA HILLS in marshes and in the NAGA HILLS in forest at 4,000 ft.

14. *Panicum montanum* Roxb. Fl. Ind. I. (1820) 313.

Perennial, base somewhat woody. *Culms* ·8-1·2 m. tall, erect, hard, solid, smooth with rigid branches, nodes 5-12 cm.

apart, glabrous. *Leaf-blades* spreading or deflexed, flat, elongate, lanceolate, acuminate, broad and cordate at the base, thin, smooth or scaberulous, glabrous or ciliate at the base principally below, 12-18 cm. long, 1-3 cm. broad, many-nerved, margins scaberulous, ciliate; sheaths shorter than the internodes, glabrous or pubescent, hairy in the throat; ligules obscure, furnished with long soft hairs.

Inflorescence a lax panicle, erect, spreading, 20-30 cm. long; rachis generally straight, sometimes glandular, somewhat scabrous at the top; branches numerous, straight, filiform, scabrous, the lower verticillate, straight and not branched, equaling the panicle in length, the upper opposite or alternate; pedicels very long, capillary, smooth, erect, swollen at the tips. *Spikelets* distant, ellipsoid or oblong, obtuse or sub-acute, glabrous or slightly pubescent, 1.5-2.5 mm. long. *Lower glume* 1.1-1.9 mm. long, ovate-subacute, embracing the spikelet, 5-nerved, sparsely hairy. *Upper glume* 1.5-2.5 mm. long, concave, sub-orbicular, ovate-obtuse, rounded at the summit, caducous, glabrous or with sparse hairs strongly 5-nerved. *Lower floret* barren; lemma 1.3-2.3 mm. long, ovate-obtuse, sometimes narrower than the upper glume, 5-nerved, epaleate. *Upper floret* hermaphrodite, shortly stipitate; lemma 1.3-2.3 mm. long, smooth, shining, coriaceous, ovoid, sub-acute, yellowish or pale-brown, rounded on the back, obscurely striate, a little shorter than the spikelet, with margins slightly inflexed; palea 1.2-2.2 mm. long, oblong-acute, of the same texture as the lemma.

Very common.

15. *Panicum sarmentosum* Roxb. Fl. Ind. I (1820) 308.

A rambling perennial. *Culms* decumbent, branched, swollen and more or less rooting at the nodes, scrambling over vegetation and may reach 15 m. in length. *Leaf-blades* spreading, linear-lanceolate, finely acuminate, narrow, rounded or sub-cordate at the base, smooth, hairy at least on the under-surface, with scaberulous margins, 30-40 cm. long, 1-3 cm. broad, many-nerved, median nerve the strongest;

sheaths somewhat loose, striate, glabrous or with scattered hairs; ligule a ridge of hairs.

Inflorescence a spreading panicle, ovoid or pyramidal, laxly branched, 8-35 cm. long; rhachis cylindrical below, angled at the summit, pubescent in the axils; branches capillary, sub-verticillate, spreading or erect, long or short; pedicels short, swollen at the tips. *Spikelets* ovoid-obtuse, ciliolate, 1·3-2 mm. long. *Lower glume* 4-1 mm. long, embracing the spikelet, ovate-oblong, obtuse or sub-acute, 3-5-nerved. *Upper glume* 1·3-2 mm. long, broader than the lower, ovate-sub-orbicular, rounded or slightly pointed at the apex, 5-nerved, pubescent at the apex. *Lower floret* barren; lemma 1·3-2 mm. long, broadly ovate-sub-orbicular, 5-nerved, pubescent at the apex; palea narrower, 9-1·3 mm., oblong, hyaline, margins fimbriate, 2-nerved. *Upper floret* hermaphrodite; lemma 1·3-2 mm. long, coriaceous, smooth, shining, ovate-oblong, sub-acute, rounded on the back, margins clasping; palea 1·3-2 mm. long, more obtuse, oblong, margins folding inwards. *Caryopsis* oblong.

Common in Sal forest.

16. *Panicum acroanthum* Steud. Syn. Pl. Glum. (1854) 87.

A perennial grass with culms up to 90 cm. tall, erect, geniculate at the base, leafy to the panicle, with glabrous nodes. *Leaf-blades* narrow, linear, acuminate, narrowed at the base, flat, thin, glabrous; sheaths glabrous, ciliate on the margins; ligule hairy.

Inflorescence a large spreading panicle, lax flowered, 7-12 cm. long and as broad; branches sub-solidary, spreading, with capillary branchlets; pedicels somewhat shorter or longer than the spikelets; branches and branchlets smooth or minutely scaberulous. *Spikelets* few in number, often in pairs, ovate-oblong, acute, brownish or greenish, usually covered with a sparse pubescence, 2·2 mm. long. *Lower glume* 6-7 mm. long, membranous, ovate, obtuse or sub-acute, 1-3-nerved. *Upper glume* 2·8 mm. long, membranous, sub-acute, 5-nerved. *Lower floret* empty; lemma 2 mm. long, mem-

branous, ovate, acute, 5-nerved; palea absent. *Upper floret* hermaphrodite; lemma 2 mm. long, shining, smooth, coriaceous, pale-yellow, elliptic-oblong, sub-acute; palea oblong, acute, with inflexed margins.

Collected by Griffith in the MISHIMI HILLS.

17. *Panicum brevifolium* Linn. Sp. Pl. (1753) 59,
not of Roxb. Syn. *P. ovalifolium* Poir. Encycl. Suppl. IV
(1816) 279.

Culms 2-1.2 m. long, rooting for part of their length, slender, geniculate, finally ascending, sparingly branched, striate, often purplish, glabrous even on the nodes, often leafy to the base of the inflorescence. *Leaf-blades* spreading, narrow, membranous, ovate-lanceolate, acuminate, cordate-amplexicaul at the base, glabrous or with scattered hairs, 3-10 cm. long, 1.3 cm. broad; margins scaberulous, ciliate at the base; nerves membranous, the median nerve more prominent below; sheaths glabrous or ciliate; ligule very short, ciliate.

Inflorescence a panicle, spreading, broadly oblong or ovate, sometimes obovoid, branches many 7.5-12 cm. long rhachis bare or furnished with scattered hairs, sometimes villous; branchlets numerous, spreading, alternate or the lower verticillate, capillary, smooth or scaberulous; pedicels capillary, equalling the spikelets in length or 2-3 times as long. *Spikelets* few solitary, somewhat gibbous, ovate or oblong, subacute, often purplish, pubescent or sometimes bristly on the margins of the panicles with long white hairs. 1.5-2.5 mm. long. *Lower glume* 1.3-2.3 mm. long, membranous, almost flat, ovate-oblong, obtuse, faintly 3-5-nerved. *Upper glume* 1.5-2.5 mm. long, hemispheric, ovate-acuminate, larger than the lower, 5-nerved, pubescent or villous, often persistent. *Lower floret* male; lemma 1.5-2.5 mm. long, membranous, almost flat, ovate-oblong, obtuse, 5-nerved; palea narrow, oblong. *Upper floret* hermaphrodite, sessile; lemma 1.2-2.5 mm. long, smooth, shining, sub-coriaceous, ovate-oblong, pointed, dorsally convex, obscurely carinate, with narrowly inturned margins; palea of the same texture, ovate-oblong, flat on the back, margins inturned.

Very common in UPPER ASSAM and in the hills up to 4,000 ft.

10. CYRTOCOCCUM Stapf.

Spikelets obliquely obovate to semi-obovate, gibbous, awnless, much compressed laterally, keeled, falling entire from the pedicels, arranged in loose and open, or contracted and dense panicles. *Florets* 2; lower barren and with or without a palea, upper hermaphrodite as long as or nearly as long as the lower. *Glumes* unequal or nearly equal, thinly membranous, 3-5-nerved. *Lower floret*; lemma as long as the spikelet similar to the upper glume; palea if present narrow; upper floret, lemma narrowly boat-shaped, gibbous, papery to coriaceous, with rigidly, narrowly involute margins, obscurely 5-nerved; palea very narrow, convex on the back, as long as the lemma and similar in texture. *Lodicules* 2. *Stamens* 3.

Perennial grasses with slender, geniculate culms ascending from a decumbent or creeping base; leaf-blades linear-lanceolate to lanceolate, or linear, flat; ligule membranous; spikelets brown or greenish brown.

Key to the species of *Cyrtococcum*.

Pedicels short, rarely as long as the spikelets.

Leaves 1·25-4 cm. long, culms slender; panicle up to 6·5 cm. long; spikelets few, hispid. 1. *C. trigonum*.

Leaves 5-18 cm. long; culms rather stout; panicle 6·5-20 cm. long; branchlets many; spikelets numerous. 2. *C. oxyphyllum*.

Pedicels longer than the spikelets.

Lower lemma obtuse.

Spikelets 2·25-2·5 mm. (over 1·5 mm.) long. 3. *C. patens*.

Spikelets under 1·5 mm. long.

Panicle very lax, pedicels fairly long. 4. *C. accrescens*.

Panicle contracted, pedicels short. 5. *C. radicans*.

Lower lemma and glumes acute or cuspidate. 6. *C. longipes*.

1. ***Cyrtococcum trigonum* A. Camus** in Bull. Mus. Nat Hist. Paris (1921) 118. Syn. *Panicum trigonum* Reiz. Obs. III (1783) 9.

Perennial. Culms 15-45 cm. high, decumbent, creeping and branched at the base; branches erect, slender or filiform, glabrous; nodes glabrous, the lower emitting very long, filiform, sub-solidary roots; leaf-blades narrow, flat, linear-lanceolate,

acuminate, contracted at the base, glabrous or with long scattered hairs, 1·8 cm. long, 2·8 mm. broad; margins almost smooth; nerves fine; sheaths glabrous or with ciliate margins especially near the throat; ligule rounded.

Inflorescence a short, stout panicle, very variable, contracted, upright, lax; axis often flexuous, smooth; branches sub-erect, angular, glabrous, smooth, often flexuous, 2·5-3 cm. long, with few spikelets; pedicels short, smooth. *Spikelets* gibbous, laterally compressed, hispid, 1·5-2 mm. long; lower glume 1·75-1 mm. long, membranous, broadly ovate-acute or cuspidate, 5-nerved, pubescent or hispid; upper glume 1·3-1·8 mm. long, helmet-shaped, obtuse, 3-nerved, pubescent. *Lower floret*; lemma 1·5-2 mm. long, obovate oblong, 5-nerved, pubescent or hispid; palea rudimentary or absent. *Upper floret* hermaphrodite, sessile; lemma 1·5-2 mm. long, shining, finely punctate, coriaceous, pale, semilunar in profile, shortly attenuate at the apex, laterally compressed, back rounded, margins not or broadly incurved; palea 1·5-2 mm. long, of the same texture as the lemma, oblong, rounded on the back.

GOALPARA.

2. **Cyrtococcum oxyphyllum** Stapf in Hook. Ic. Pl. Sub. tab. 3096 (1922). Syn. *Panicum pilipes* Nees et Arn. ex Buese in Miq. Pl. Jungh. III (1854) 376.

A loosely rambling perennial. *Culms* ascending from a creeping base and rooting at the lower nodes, 20-60 cm. or more high, slender, terete, branched at the base, many-noded, glabrous and smooth. *Leaves* scattered; blades linear-lanceolate, finely acuminate, contracted or rounded at the base, 4-20 cm. long, 4-20 mm. wide, pubescent to pilose or glabrous, minutely scaberulous on the margins; sheaths at length shorter than the internodes, shortly hairy or more or less glabrous; ligule very short truncate.

Panicle contracted, lanceolate to narrowly ovate, 4-18 cm. long; rhachis asperulous; branches erect or spreading, naked at the base, divided above, with the branchlets short and close together, filiform, usually with long white scattered hairs; pedicels very short. *Spikelets* crowded, broadly and

obliquely obovate, obtuse, 1·6-2 mm. long, brown, glabrous. *Glumes* acute or obtuse, 3-nerved; lower ovate, 1·1-1·6 mm. long; upper elliptic or semi-elliptic in sideview, 1·5-1·8 mm. long. *Lower floret*; lemma broadly elliptic and obtuse when flattened, 3-5-nerved. *Upper floret*; lemma coriaceous, smooth and shining with a brown scar or crest at the apex.

Very common up to 4,000 ft.

3. *Cyrtococcum patens* A. Camus in Bull. Mus. Natl. Hist. Paris, XXVII (1921) 118. Syn. *Panicum patens* Linn. Sp. Pl. (1753) 86.

Perennial herb. *Culms* 30-60 cm. long, rooting at the base, branched, slender, terete, delicately striate, nodes glabrous, somewhat geniculate, the lower emitting very long, solitary roots. *Leaf-blades* narrow, spreading flat, from broadly ovate to linear-lanceolate, finely acuminate, glabrous or ciliate below, with tubercle-based hairs, 3-1·5 cm. long, by 6-8 mm. wide, margins hispid, hairs from tubercular bases; sheaths ciliate on the margins at the throat; ligule membranous, short obtuse.

Inflorescence a lax panicle, often nodding, spreading or contracted; branches spreading, long, flexuous, the lower verticillate, the upper solitary or in pairs; branchlets very long, distant, often spreading; pedicels capillary, often long, glabrous. *Spikelets* almost round, green, reddish or brown. 1·8 mm. long; glumes herbaceous, membranous; lower glume 1·6-1·2 mm. long, cordate, ovate obtuse or scarcely acute, 3-5-nerved; upper glume 1·8-1·5 mm. long, helmet-shaped, elliptic-oblong, 3-nerved, glabrous or ciliate on the summit. *Lower floret*; lemma 1·8 mm. long, sub-elliptic, obtuse or somewhat acute, 3-nerved, lateral almost marginal, glabrous or ciliate at the apex; palea short. *Upper floret* hermaphrodite; lemma 1·8 mm. long, coriaceous, cartilaginous, whitish, cordate, semi-rounded, acute, mucronulate, sub-compressed, finely punctate, scarcely 3-nerved; palea 1·8 mm. long, 2-nerved, mucronulate. *Lodicules* quadrangular, shorter than the ovary.

A forest grass common all over the province up to 4,000 ft.

4. **Cyrtococcum accrescens** Stapf in Hook. Ic. Pl. sub tab. 3096 (1922). Syn. *Panicum accrescens* Trin. Sp. Gram. Ic. I (1828) t. 88.

Perennial. *Culms* tall, from a branching and decumbent base, often branching at the lower nodes, leafy to the top, nodes glabrous. *Leaf-blades* linear-lanceolate, ovate-lanceolate or lanceolate, contracted at the base, tapering to a sharp point, many nerved, smooth, margins scarcely thickened, smooth, with a few hairs at the base and on the margins a few tubercle-based hairs, 2·5 cm. to 10 cm. long, 4 mm. to 1·5 cm. broad; sheaths closely fitting, striate glabrous and smooth, or hairy, hairs from tubercle bases, margins usually ciliate; ligule a narrow membranous rim.

Inflorescence a very lax panicle, up to 25 cm. long, by 15 cm. broad; branches and branchlets capillary, straight or flexuous, absolutely smooth and glabrous. *Spikelets* 1·5 mm. long, pedicels of side spikelets up to 8 mm. long, slightly swollen and cup shaped at the tips. *Lower glume* ovate-acute, 1·75 mm. long, 3-nerved; upper glume deeply boat-shaped, 5-nerved; lower lemma ovate-oblong, 5-nerved, palea shorter than the lemma. *Upper lemma* 1·25 mm. long, yellowish or white, coriaceous, bellied, striate-punctate; palea of the same texture just shorter than the lemma.

Plains and hills up to 6,000 ft.

5. **Cyrtococcum radicans** Stapf in Hook. Ic. Pl. sub tab. 3096 (1922). Syn. *Panicum radicans* Retz. Obs. IV (1786) 18.

Perennial. *Culms* up to 45 cm. high, decumbent, creeping and branching below, sending up shoots, with long fibrous roots from the lower nodes; internodes longer than the leaf sheaths below; nodes and stem glabrous. *Leaf-blades* ovate to lanceolate, 2·5-7 cm. long, 5 mm.-1·5 mm. wide, gradually tapering to an acuminate tip, many nerved, nerves slender, both surfaces usually hairy with soft white hairs or practically glabrous, margins scarcely thickened, smooth; leaf sheaths striate, hispidly hairy with long hairs from tubercle-bases; margins long ciliate, throat hairy; ligule narrow, membranous, truncate.

Inflorescence a panicle, always contracted, branches few ascending, flexuous, smooth, spikelets gibbosus, on rather short pedicels giving effect of a very close panicle; spikelets rarely exceeding 1.5 mm. long. *Lower glume* ovate-acute, .75 mm. long, 3-nerved; upper glume awned, keeled, 5-nerved. *Lower floret* barren; lemma ovate-acuminate, 5-nerved. 1.5 mm.; palea somewhat less than .75 mm. long; upper lemma much compressed, humped, yellowish or white, finely striate, punctate, 1.25 mm. long; palea of the same texture, narrow, slightly shorter than the lemma.

Hills and plains up to 6,000 ft.

6. *Cyrtococceum longipes* A. Camus in Bull. Mus. Nat. Hist. Paris, XXVII (1921) 118. Syn. *Panicum longipes* W. et A. in Wight, Cat. n. 1638.

Stems erect from a decumbent base, smooth and glabrous, .75-1 m. tall. *Leaves* 10-25 cm. long, .8-1.6 cm. broad, narrowed into a fine acuminate point, sparsely hairy at the base, finely puberulous beneath; sheaths nearly glabrous; ligule rounded.

Panicle 12.5-25 cm. long, fastigiate branched; branches simple below and naked for about 2.5 cm., then fastigiate branched; branches and long pedicels capillary; spikelets 2.2-2.5 mm. long glabrous, pale brown. *Lower glume* 2-2.5 mm. long, acuminate, 3-nerved; upper glume as long, acute; lower and upper lemmas with sparingly ciliolate tips acute.

What may be a small form of the plant was collected at Golaghat, SIBSAGAR by C. B. Clarke.

11. ECHINOCHLOA Beauv.

Spikelets ovate to elliptic or lanceolate-oblong, usually cuspidate or awned, very convex on the back, flat or slightly depressed in front; falling entire from the pedicels, 2-nate or culstered, secund and abaxial on the triquetrous rhachis of racemosely arranged, false spikes. *Lower floret* male or barren; upper floret hermaphrodite. *Glumes* unequal, membranous, the lower much shorter, more or less ovate from a clasping base, 3-5-nerved, acute, cuspidulate or cuspidate, rarely produced into a short awn. *Lower floret* equalling the

upper glume (excluding cusps or awns); lemma very similar to the upper glume but flat and depressed on the back and often with a more pronounced cusp or awn; palea equalling the lemma in length or in barren florets more or less reduced, hyaline, finely 2-keeled. *Upper floret*; lemma ovate- to elliptic-oblong, apiculate or obtuse, very convex on the back, subcoriaceous or crustaceous, polished, faintly 5-nerved, margins firm involute, not embracing tip of the palea; lemma and palea sub-equal and similar in substance, with rounded keels and flaps. *Lodicules* 2, cuneate, fleshy. *Stamens* 3. *Styles* distinct; stigmas plumose, exserted from near the tips. *Grain* broadly elliptic, dorsally flat, ventrally convex; hilum punctiform, sub-basal.

Pezennial soft, tall or annual grasses; blades linear from a slightly constricted, or equally wide, rarely much attenuated base; ligule 0 or represented by a fringe of hairs; panicles of crowded or loosely arranged, secund, spiciform branches mostly bearing spikelets from the base or near it. *Spikelets* more or less hispid on the nerves of the glumes; and the lower lemma usually almost smooth.

Key to the species of *Echinochloa*.

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----------------------------|
| Ligule a fringe of stiff hairs, at least in the lower leaves. | .. | .. | 1. <i>E. stagnina</i> . |
| Ligule absent. | | | |
| Spikelets 5-6 mm. long. | .. | .. | 2. <i>E. frumentacea</i> . |
| Spikelets up to 4 mm. long. | | | |
| Lower glume and upper lemma equally acute or cuspidate, racemes rather distant. | | | 3. <i>E. colonum</i> . |
| Lower glume and upper lemma cuspidate or produced into an awn, the former less than the latter. | | | |
| Spikelets 3-8 mm. long, generally in simple false spikes, cuspidate or more or less awned from the lower floret, sheaths slightly compressed; blades hardly decurrent. | .. | .. | 4. <i>E. crus-galli</i> . |
| Spikelets 3-3.7 mm. long, very densely clustered in often compound false spikes, abruptly caudate-acuminate or rostrate or (from the lower floret) aristulate; margin of leaf base often decurrent, sheaths rounded. | .. | .. | 5. <i>E. crus-pavonis</i> . |

1. *Echinochloa stagnina* Beauv. Ess. Agrost. (1812) 161. Syn. *Panicum crus-galli* Linn. Sp. Pl. (1753) 56 (in part).

Perennial. *Culms* up to 2 m. from long creeping and copiously rooting rhizomes, geniculate at the base, rooting from the lower nodes, slender to stout, many noded, simple, smooth and glabrous. *Leaf-blades* linear from a slightly narrowed base, long tapering to a fine point, 15-45 cm. long, 6 mm.-2.5 cm. broad, flat, rigid, glabrous, green, rough; margins scabrid to spinulose; sheaths terete or keeled upwards, smooth and glabrous, usually ciliate near the mouth; ligule a fringe of rather stiff hairs, sometimes absent at the top.

Inflorescence a more or less nodding and secund panicle, 10-25 cm. long, made up of few to many branches, distant or rather crowded, alternate sub-erect, rhachis and branches hispidulous or scabrid, sometimes hirsute all over; pedicels usually 2-nate, tips discoid. *Spikelets* ovate, oblong to lanceolate-ovate, 5.7-5 mm. long; glumes thin, minutely, rigidly and appressedly pubescent between the hispidulous nerves, the cilia on the nerves often arising from tubercle bases; lower ovate to ovate-lanceolate, acute or acuminate, more or less mucronate, 3- to 5-nerved; upper corresponding in outline to the spikelet, concave, caudate acuminate or produced into a short, scabrid, compressed awn, 5-to 7-nerved at the tip, spinulose on the sides. *Lower floret* male or sometimes barren; lemma similar to the upper glume but flat or depressed on the back, sub-hyaline except at the herbaceous-membranous sides, produced into an awn 5 mm.-3 mm. long: palea oblong, with more or less scaberulous nerves. *Upper floret* hermaphrodite; oblong to lanceolate-oblong, mucronate-acuminate, 3.7-6.5 mm. long, straw coloured, polished: lemma and palea subcoriaceous, crustaceous. *Caryopsis* obovate-oblong, 3.1 mm. \times 1.6 mm., white. *Stamens* 3 in the upper and lower florets, 2 mm. long, translucent, dotted.

Very common in marshes in the plains.

Considered to be particularly rich grass for horses and cattle; the seed is edible and is collected in times of want. The submerged stems are rich in sugar and molasses is prepared from them in Africa.

2. Echinochloa frumentacea Link, Enum. Hort. Berol. (1827) 204.

Annual. Very robust, tufted, culms up to 1.5 m. tall, terete, smooth and glabrous, much branched from the swollen lower nodes; roots many, fibrous. Leaves linear lanceolate, acuminate, flaccid, up to 60 cm. long, 1-2 cm. broad, tapering gradually in the lower half to their insertions on the sheath, the junction being marked with a white ring, smooth and glabrous on both surfaces, scabrid on the margins; midrib white, prominent and sunk on the upper surface, appearing as a rounded keel on the lower surface; sheaths loose, membranous, longer than the internodes, slipping from the culms, smooth and glabrous, compressed and keeled in the upper half; ligule a glabrous, fleshy ring.

Inflorescence a panicle made up of alternate, 2-nate or 3-nate, closely spiculate, false spikes rather distant on a central axis. *Axis* angled, and scabrid on the angles, branched, villous at the insertion of the branches. *Branches* scabrid; branchlets 2-3 spiculate. *Spikelets* 5-6 mm. long, obovate-acute, cuspidate, turgid, plano-convex in outline. *Lower glume* 3 mm. long, clasping, broader than long, apiculate; 5-nerved, scabrid on the nerves, minutely hispid in the interspaces; upper glume shape of the spikelet, cuspidate, compressed, 5-6 mm. long, 5-nerved, often 7-nerved at the apex, scabrid on the nerves, minutely hispid in the interspaces. *Lower floret* empty; lemma shape of the spikelet, compressed cuspidate, 5-6 mm. long, 7-nerved, scabrid on the nerves, minutely hispid between the nerves; palea 3 mm. long, broadly ovate, obtuse, ciliolate on the margins with two infolded flaps. *Upper floret* hermaphrodite; elliptic acute, chartaceous, compressed at the tip which is minutely ciliolate; palea broadly elliptic acute, of the same texture, rounded on the margins, broadly infolded. *Lodicules* 2, cuneate, concave on top. *Anthers* 3.1-5 mm. long. *Styles* 2, stigmas plumose.

A very robust grass with very large spikelets. Called *raishan* in Khasi. It is mixed with rice in the manufacture of rice beer. Is considered to be a very valuable fodder grass.

3. ***Echinochloa colonum*** Link. Hort. Berol (1827) 209.

An annual growing in small tufts up to 60 cm. high. *Culms* slender, erect or geniculately ascending, branched mostly in the lower part only, glabrous and smooth. *Leaves*: blades glabrous, rarely with some minute hairs on the blades, linear from a scarcely contracted base, tapering to a slender acute point, flat, flaccid, (sometimes with black cross bands) delicately pruinose, margins slightly rough; sheaths somewhat loose, more or less compressed, thin, smooth; ligule 0: junction of blade and sheath glabrous inside.

Inflorescence an erect panicle, 5-12.5 cm. long, very narrow; branches from 6 to many, solitary rarely 2-nate, erect and often appressed to the axis, or sometimes obliquely spreading, rather distant on the rhachis, lower 2.5-3.1 cm. long, upper decreasing gradually in length, forming dense simple, moderately stout sub-secund, sessile false spikes; pedicels 2-nate or fascicled lower down, very short, scaberulous, tips sub-discoid. *Spikelets* crowded, usually approximately 4-ranked, ovate to ovate-elliptic in outline, acute or cuspidate, 3.1-3.7 mm. long. *Lower glume* membranous, very broadly ovate and clasping at the base, acute to cuspidate 1.25 mm. long, scaberulous; upper glume sub-herbaceous, membranous, elliptic-ovate in outline, very concave, acute or cuspidate, 5-7-nerved, minutely pubescent between the scaberulous nerves. *Lower floret* male (always): lemma similar to the upper glume but flat or depressed on the back; palea oblong, acute, almost as long as the lemma; keels scaberulous upwards; upper floret hermaphrodite, elliptic-ovate or sub-ovate, cuspidulate, from less than 2.5 mm. to over 2.5 mm. long, yellowish or whitish, polished; lemma and palea subcoriaceous; anthers .9 mm. long. *Grain* broadly elliptic in outline, plano-convex, 1.9 mm. long.

A valuable fodder grass at all stages. Formerly cultivated in Egypt as a cereal. Not uncommon in the plains.

Seeds eaten in time of want.

4. *Echinochloa crus-galli* Beauv. Ess. Agrost. (1812)
 161. *Panicum crus-galli* Linn Sp. Pl. (1753) 56.

Annual. *Culms* 30-1 m. high, geniculately ascending, slender to moderately stout, branched below, glabrous and smooth. *Leaf-blades* linear, from a scarcely narrowed base, tapering to an acute point 7·5-25 cm. long, 7·5-20 mm. wide, flat, sub-flaccid, smooth or scaberulous below, margins finely cartilaginous, scabrid to almost smooth; sheaths somewhat loose, the lower often compressed, all smooth, glabrous and striate except the basal which are pubescent above their insertion; ligule 0; junction of blade and sheath glabrous inside, marked by a brown zone.

Inflorescence an erect, stout or flexuous lobed panicle, 7·5-20 cm. long: axis triquetrous, scabrid, coarsely bristly: branches few to about 15, solitary or 2-nate, sub-erect or spreading, distant except the uppermost; pedicels fascicled or 2-nate, very short, scabrid, bristly at the base, tips subdiscoid. *Spikelets* crowded, ovate-elliptic in outline, acute, cuspidate or awned, 3·1-3·7 mm. long. *Lower glume* membranous, broadly ovate, clasping, obtuse to subcuspidate, 1.25 mm. long, 5-nerved, scaberulous; upper glume herbaceous membranous, very broadly ovate-oblong, concave, acute, cuspidate, as long as the spikelet, 5- or more, the tip 7-nerved, rigidly pubescent between the scaberulous and spinulose nerves. *Lower floret* barren; lemmas similar to the upper glume, but flat and depressed on the back, cuspidate or produced into a scabrid, often long flexuous awn, 7-nerved (at least at the tip); palea elliptic, 3/4 length of the lemma, keels scaberulous upwards. *Upper floret* hermaphrodite; elliptic-ovate in outline, cuspidate, over 2.5 mm. long, whitish or yellowish, polished; lemma and palea subcoriaceous; anthers oblong. *Caryopsis* broadly elliptic in outline, 1.3 mm. long.

There are apparently two forms: (a) A hairy narrow spikeletted form with a lanceolate lower glume more than half the length of the spikelet; usually awned; (b) the other with fat spikelets; lower glume sub-acute, less than half the length of the spikelet and the spikelets usually awnless or shortly awned.

Seeds eaten in time of want. A very common grass in paddy fields.

**5. *Echinochloa crus-pavonis* (H. B. K.) Schult.
Mant. II (1824) 269.**

An annual. *Culms* erect, stout, up to 1.75 m. tall, thick and spongy below, glabrous, smooth, sheathed all along; the nodes at length exserted. *Leaf-blades* linear to lanceolate-linear, base slightly narrowed, base often long decurrent in the upper leaves, tapering to a very long fine point, 12.5 to over 32 cm. long, 1.25-2.5 cm. long, flat, rather fine, glabrous, usually smooth; margins cartilaginous, scabrid to spinulose; sheaths terete, striate, smooth, quite glabrous or rarely slightly hirsute towards the junction with the blade, or ciliate upwards; ligule 0.

Inflorescence an erect panicle, linear-oblong to linear-lanceolate in outline, 10-30 cm. long, usually dense; axis triquetrous, scaberulous to very scabrid, branches solitary or frequently subopposite, mostly approximate and nearly always longer than internodes, obliquely erect, often very numerous, 1-2.5 cm. long, forming sessile stout compound false spikes, pedicels fascicled or very short and contracted; branchlets 2-nate, very stout, scabrid. *Spikelets* in compact clusters, ovate-elliptic or elliptic-oblong, abruptly caudate-acuminate or rostrate, about 3.1-3.7 mm. long. *Glumes* membranous rather thin, appressedly minutely and rigidly pubescent between the slender, spinulose nerves; lower very broadly ovate from a clasping base, acute to sub-acuminate, 1/3 to almost half the length of the spikelet, 3- to 5-nerved; upper glume corresponding in shape and length to the outline of the spikelet, tips shortly mucronate or cuspidate, very concave, 5-nerved. *Lower floret* barren; lemma similar to the upper glume but flat or depressed on the back with cuspidate or aristate tips, awn slender, scaberulous; palea oblong, scaberulous above. *Upper floret* hermaphrodite, elliptic or ovate-oblong, sub-acuminate or cuspidate, up to 3.1 mm. long, greenish or greenish white, polished; palea and lemma sub-coriaceous to crustaceous; anthers .6 mm. long. *Caryopsis* broadly elliptic in outline, 1.5 mm. long.

Common in paddy fields.

12. OTTOCHLOA Dandy.

Spikelets narrowly elliptic to oblong or elliptic-oblong, acute or obtuse, awnless, dorsally compressed, abaxial, falling entire from the pedicels, arranged in short, or very short, racemes along the slender branches of contracted or open panicles. *Florets* 2; lower barren and reduced to the lemma; upper hermaphrodite, as long or nearly as long as the lower. *Glumes* similar, nearly equal, much shorter than the spikelet, membranous, lower lanceolate to ovate, 3-nerved, upper ovate to ovate-oblong, 3-7-nerved. *Lower floret*; lemma corresponding in outline to the spikelet, membranous, slightly depressed on the back, 7-9-nerved. *Upper floret*; lemma similar in outline to the spikelet, sub-coriaceous with narrowly hyaline, ciliolate margins, smooth or nearly so, obscurely 5-7-nerved; palea as long as the lemma and similar in texture, finely 2-nerved. *Lodicules* 2. *Stamens* 3. *Caryopsis* elliptic, dorsally compressed; scutellum nearly half the length of the caryopsis; hilum basal.

Perennial grasses; culms geniculate, often ascending from a procumbent base and rooting at the nodes; blades lanceolate-linear to lanceolate or linear, flat; ligules membranous; racemes more or less scattered.

Ottochloa nodosa Dandy, Jour. Bot. LXIX (1931) 54.
Syn. *Panicum nodosum* Kunth, Enum. Pl. I (1835) 97.

A rambling perennial. *Culms* geniculately ascending from a creeping base, rooting at the lower nodes, up to 90 cm. high, slender, terete, finely striate, many-noded simple or branched at the base, usually glabrous and smooth. *Leaf-blades* lanceolate-linear to lanceolate, tapering to an acute tip, rounded or abruptly contracted at the base, 4-15 cm. long, 4-14 mm. wide, spreading, closely nerved and rough on the upper surface or smooth, glabrous or with scattered tubercle-based hairs. *Leaf-sheaths* much shorter than the internodes, loose, ciliate on the margins, otherwise glabrous, or loosely (rarely densely) hirsute with tubercle-based hairs; ligule truncate, about 0.5 mm. long.

Panicle loose, 8-25 cm. long; branches filiform, angular, scaberulous, solitary or the lower sometimes clustered, the

latter up to 15 cm. long; racemes up to 1.8 cm. long, few to 9-spicate; pedicels very short. *Spikelets* oblong or narrowly elliptic-oblong, obtuse or acute, 2.8-3.5 mm. long, glabrous or rarely minutely hairy. *Lower glume* lanceolate, acute, 1.5-2.5 mm. long, 3-nerved; upper glume ovate to ovate-oblong, obtuse, 2-2.5 mm. long, 5-7-nerved. *Lower floret*; lemma elliptic-oblong and obtuse when flattened, 7-nerved. *Upper floret*; lemma elliptic-oblong, minutely granular. *Anthers* 1.2 mm. long.

Superficially this grass is similar to *Panicum auritum* Presl, but can easily be distinguished from it by the fact that the lower and upper glumes are sub-equal; in *P. auritum* the upper glume is nearly the length of the spikelet.

Common in both valleys and in the hills up to 3,000 ft.

13. PASPALUM Linn.

Spikelets orbicular to oblong, obtuse, rarely acute or acuminate, falling entire from the very short or obscure pedicels, secund and usually 2-nate on the flattened or triquetrous rhachis of false spikes, plano-convex; lower floret barren; reduced to the lemma, rarely with a rudimentary palea; upper floret hermaphrodite. *Lower glume* absent or minute; upper membranous, as long as the lemmas, rarely shorter or obsolete, usually with 1-2 submarginal side nerves on each side, with or without a middle nerve, rarely nerveless. *Lemmas* equal or sub-equal, lower resembling the upper glume usually 3-5- (rarely 7-) nerved, with the side nerves curved, close, mostly submarginal and distant from the middle nerve when present; upper lemma chartaceous to sub-coriaceous, faintly 5-7-nerved; palea subequal to, and of the same texture as the lemma, 2-nerved. *Lodicules* 2, cuneate. *Stamens* 3. *Styles* distinct, slender; stigmas laterally exserted near the tip of the floret. *Caryopsis* tightly enclosed by the slightly hardened lemma and palea, dorsally sub-compressed; hilum basal, punctiform; embryo less than half the length of the grain.

Perennial or annual grasses; racemes 2-nate, digitate or panicled.

Key to the species of *Paspalum*.

- | | | |
|-------------------------------------------------------------------------------------------------------------------------------|----|------------------------------------------------|
| Spikelets small, up to 1.25 mm. . . . | 1. | <i>P. compactum.</i> |
| Spikelets larger, over 1.25 mm. | | |
| Spikelets in 4 rows; rhachis wide; upper glume pubescent. | 2. | <i>P. longijolium.</i> |
| Spikelets in 2 rows; rhachis narrow. | | |
| Spikelets glabrous. | | |
| Spikelets broadly elliptic or orbicular. | | |
| Spikelets 2.5-3 mm.; annual; lower lemma 5-nerved. | 3. | <i>P. scrobiculatum.</i> |
| Spikelets up to 2.5 mm.; perennial; lower lemma 3-nerved. | 4. | <i>P. orbiculare.</i> |
| Spikelets elliptic-oblong, minutely pubescent on upper glume; mid-nerve of lower lemma prominent, lower glume minute. | 5. | <i>P. distichum.</i> |
| Spikelets ciliate. | | |
| Spikelets small up to 2.5 mm., yellowish green. | | |
| Spikelets 1.4-1.5 mm. long. | 6. | <i>P. conjugatum.</i> |
| Spikelets 1.7-2.2 mm. long | | <i>P. conjugatum</i>
var. <i>pubescens.</i> |
| Spikelets 2.2-3 mm., purple. | 7. | <i>P. dilatatum.</i> |

1. *Paspalum compactum* Roth, Nov. Pl. Sp. (1821)

36.

Annual. Culms 15-25 cm. tall, ascending from a decumbent base, rooting and branched at the lower nodes, often leafy to the top, deeply striate, very hairy at the nodes. Leaf-blades ovate-lanceolate, acuminate, erect or spreading, base rounded and decurrent, many nerved, the nerves forming parallel ridges along the upper surface, flat, flaccid, very hairy on both surfaces, the hairs arising from small tubercle bases; margins scarcely thickened, ciliate along the margins with long white hairs; sheaths finally shorter than the internodes, rather loose, very striate, nerves raised, white, in between the nerves are rows of white tubercles from which arise long white hairs; margins hirsute; ligule a rim of stiff white hairs.

Inflorescence a raceme of false spikes, solitary, or a very small false spike with one or two spikelets at the insertion of the longer spike, often subopposite; false spikes

decreasing in length upwards; lower about 2 cm. long; rhachis scarcely 1 mm. wide, convex, smooth on back and margins, a few white hairs in the axils and along the margins of the rhachis; axis triquetrous, deeply sulcate. Spikelets packed in 2 rows, seated upon short pedicels, 1 m. in length or a little longer, ovate-lanceolate, plano-convex in shape. Lower glume absent; upper glume as long as the spikelet, broadly ovate, convex, 5-nerved, the margins hyaline and folding round the upper floret; lower floret, sterile; lemma as long as the spikelet, flat; margins hyaline, scarious, ovate-obtuse in shape, 3-nerved; upper floret hermaphrodite; lemma broadly elliptic, scarcely apiculate, dull white or yellow, chartaceous, minutely punctate, palea of the same substance and texture and shape as the lemma. Stamens 3; anthers .5 mm. long.

Common in marshes in the hill districts.

2. *Paspalum longifolium* Roxb. Hort. Beng. (1810)

7.

A perennial grass with a well-developed rootstock. Culms .80-1 m. tall, numerous, erect or somewhat decumbent at the base, simple, rounded, slender at the top, glabrous. Leaf-blades 35-80 cm. long, 4-6 (rarely 10) mm. wide, erect, linear-acute, the lower carinate, the upper more or less flat, glabrous except at the base, margins scaberulous; sheath very long, rather lax, keeled and with some hairs near the top, otherwise glabrous; ligules short, scarious, with a few hairs.

Inflorescence a panicle made up of 6-24 false spikes often only 8-10, 5-8 cm. long, alternate, the lower more distant, often sinuous; rhachis almost as broad as the 4 rows of spikelets, glabrous on the back, margins flexuous, often purplish; pedicels glabrous or scaberulous, in rows, those of the outer row the longer, about $\frac{1}{2}$ the length of the spikelets. Spikelets 4-seriate, numerous; 1.5-2 mm. long, very imbricate, lenticular compressed, obovoid or oblong, mucronulate, green or violet, pubescent; lower glume absent; upper 1.5-2 mm. long, rather concave, membranous, obovate-oblong or oblong,

3-nerved; pubescence short. *Lower floret* barren; lemma equal and similar to the upper glume but flatter, 5-nerved; upper floret hermaphrodite; lemma 1.5-2 mm. obovate-oblong, slightly obtuse, coriaceous, shining, delicate, punctate, striate, very pale, with thick incurved margins embracing the palea; palea 1.5-2 mm. long, of the same shape and texture as the lemma with 2 large flaps at the base embracing the caryopsis. *Caryopsis* rounded, blackish.

Plains and hills up to 4,000 ft.

Var. lorirhachis Bor, varietas nova. *Rhachis* racemorum late, usque ad 8 mm. alata.

Specimens collected near Bhomraguri, DARRANG, are very robust with the rhachis very broad, up to 8 mm. across, with margins wrapped round the 4-seriate rows of spikelets. Typus in Herb. Dehra Dun. No. 78485, Bor.

3. *Paspalum serobiculatum* Linn. Mant. I (1767) 29.

An annual grass. *Culms* erect or shortly decumbent at the base, 0.15-1.80 m., tufted, lower nodes often rooting, glabrous, very rarely hairy. *Leaves* almost if not quite erect, lanceolate or linear-lanceolate, acuminate, flat, base keeled compressed, scarcely contracted, more or less pubescent or glabrous, 15-40 cm. long by 2-8 mm. wide, margins scaberulous; ligule very short membranous.

Inflorescence a panicle consisting of 2 to several false spikes, distant, erect or spreading, 1.5-15 cm. long; the rhachis is flattened attaining 2 mm. in breath rarely 3 mm., back striate margins scaberulous; pedicels equalling half the spikelet in length or even less. *Spikelets* secund, in 2 rows, 2-3.5 mm. long, imbricate, orbicular or sub-ovoid, plano-convex, glabrous; lower glume absent; upper 2-3.5 mm. long, concave, membranous, orbicular or sub-ovate, 5-7-nerved, glabrous. *Lower floret* neuter; lemma equal to and resembling the upper glume, almost flat, 5-7-nerved. *Upper floret* hermaphrodite; lemma 2-3.5 mm., orbicular or sub-ovate, thick, coriaceous, shining, scarcely punctate or striate, greenish or brown, margins involute; palea equalling the lemma in length and of the same texture, ovate or sub-orbicular, convex on the back, ventral surface with two large

flaps from below the middle embracing the caryopsis; lodicules quadrangular, emarginate. *Caryopsis* bi-convex, pale.

An annual. Doubtfully found in Assam.

4. *Paspalum orbiculare* Forst. Prodr. (1786) 7.

A perennial. *Culms* up to 75 cm. tall, from a slightly geniculate base, spongy below, terete above, smooth and glabrous, tufted, branched below. *Leaf-blades* sub-lanceolate-linear, up to 35 cm. long, 3-10 mm. wide, tapering to a very fine point, margins sometimes involute at the tip, smooth and glabrous on the surface, margins scarcely rough, or minutely scabrid or long ciliate (in one form, perhaps a variety, the surfaces are covered with spaced, long, white hairs) hardly contracted at the base: often a tuft of hairs on the collar at junction; sheaths rather loose, compressed below, scarious, persistent, smooth, glabrous, striate, or very hairy with white hairs, margin glabrous or ciliate.

Inflorescence consisting of a number of (2-5 or 6) false spikes, usually erect but often horizontal and drooping; racemes alternate, 3-7 cm. long; rachis straight, convex, smooth and glabrous, 1-2 mm. wide, minutely striate on the margins: common axis flat, winged at the tip, smooth and glabrous except for a few hairs in the axils, pedicels stout, about $\frac{1}{2}$ the length of the spikelets. *Spikelets* many in 2 rows, overlapping, plano-convex, 1.8-2.2 mm. long, ovate-elliptic, broadly ovate or orbicular, smooth and glabrous. *Lower glume* absent; upper glume similar to the spikelet in shape, 5-nerved, very convex, glabrous. *Lower floret* sterile; lemma membranous, similar in shape and texture to the upper glume, flat, 3-nerved, this feature is not constant, however, and there may be one or two extra-marginal nerves and the side nerves may be double. *Upper floret* hermaphrodite; lemma sub-coriaceous to sub-crustaceous, yellow or brown in colour, punctate, polished, 1.5 mm. long, margins only slightly involute; palea of the same texture, shape and material as the lemma; at the middle on the ventral surface are two hyaline flaps which are folded over the stamens and ovary. *Stamens* 3, anthers .75 mm. long.

Very common up to 6,000 ft.

5. Paspalum distichum Linn. Syst. Nat. ed. 10, II (1759) 855.

A widely creeping perennial with sub-compressed culms and slender rhizomes, extensively stoloniferous, often forming loose mats, the stolons usually slender, sub-compressed, sometimes as much as 1 m. long; dark nodes often with a few ascending hairs. *Leaf-blades* flat, ascending, 3-12 cm. long, 2-6 mm. wide, wide at the rounded ciliate base, tapering to an acuminate, sometimes involute, apex dull green, relatively soft in texture, occasionally minutely pubescent on the upper surface; sheaths loose, keeled, commonly pilose on the margins towards the summit; ligule membranous about 3 mm. long.

Inflorescence of 2 racemes, rarely as many as four, from erect to reflexed, commonly incurved, 1.5-7 cm. long, rarely longer; rhachis slightly pedunculate in one, sometimes in both racemes, with usually a few long white hairs in the axils, 1-1.5 mm. rarely 2 mm. wide, triquetrous, minutely scaberulous on the margin. *Spikelets* solitary, rarely in pairs in the middle of the racemes, imbricate, 2.5-3.5 mm. long (rarely 4), elliptic, abruptly acute, pale-green; lower glume occasionally developed. *Upper glume* and sterile lemma equal, 3-5-nerved, the mid-nerve relatively prominent, the glume minutely appressed, pubescent; caryopsis 2.5-2.8 mm. long, elliptic.

The grass is a useful soil-binder and a good fodder grass. Common in the plains.

6. Paspalum conjugatum Berg. in Act. Helv. Phys. Math. VII (1762) 129. tab. 8.

Annual or perennial. *Culms* 20-60 cm. long, creeping and stoloniferous; stolons lengthy, strong, rooting at the nodes. *Culms* often erect, rounded or compressed, striate glabrous. *Leaf-blades* 5-20 cm. long by 6-12 mm. wide, linear-lanceolate, acute or acuminate, flat or compressed at the base, soft, covered with scattered hairs especially on the upper surface, margins densely ciliate, particularly at the base; sheaths very broad, lax, compressed, open to the base, striate, glabrous, ciliate on the margins, towards the summit

and on the throat, those of the upper leaves extended: ligules reduced to a pubescent ridge.

Inflorescence consists of 2 false spikes, rarely 3. 7.5-12 cm. long, very slender, erect, then spreading, very shortly pedicelled; rachis narrower than the spikelet, straight or slightly flexuous, 3-nerved and convex on the back, strongly keeled, margins almost smooth; pedicels alternate, short, glabrous or pubescent, equal. *Spikelets* 2-seriate, deciduous. 1.4-1.5 mm. long, very imbricate, orbicular-ovate, apiculate, lenticular, compressed, pale greenish yellow or whitish, pubescent; lower glume absent; upper glume slightly convex, membranous, ovate-orbicular, slightly acute, marginal nerves long ciliate; hairs white, very thin, not wavy, or swollen at the top. .5-1 mm. long. *Lower floret* barren: lemma almost flat, nearly glabrous, similar in shape, length and texture to the upper glume. *Upper floret* hermaphrodite: lemma slightly convex, slightly coriaceous, broadly ovate, sub-apiculate, greenish-white, smooth, very glabrous, with margins narrowly incurved. 1.2-1.5 mm. long; palea similar to the lemma in texture and length, ovate oblong, margins thin, incurved, 2 flaps at the base; stamens short, oblong; filaments short. *Ovary* elliptic, glabrous; style short; stigmas light coloured.

This grass often invades plantations of forest species and is considered a pest. It is, however, a valuable fodder, appreciated by animals. Can be used as a lawn grass. Very common everywhere.

Var. *pubescens* Doell in Mart. Fl. Bras. II (1877) 55.

On the average coarser than the type, the blades commonly 15-20 cm., occasionally 25 cm. long, usually papillose-pubescent on both surfaces; racemes commonly 10-15 and at times 20 cm. long; spikelets 1.7-2.2 mm. long, rather more copiously ciliate than is usual in the species.

Plains of GOALPARA.

7. *Paspalum dilatatum* Poir. in Lamk. Encycl. V. (1804) 35.

A robust herb. .90-1.5 m. tall, with a thick rhizome. *Culms* erect, rigid, more or less flattened, often simple, glabrous, somewhat geniculate at the lower nodes, very leafy at

the base. *Leaves* erect, linear-lanceolate, long acuminate, flat, keeled at the base, glabrous, with long white hairs in the throat of the sheath, 30-60 cm. long, 5-15 mm. wide, margins cartilaginous, finely undulate, scaberulous; sheaths broad, compressed, open, striate, the lower with long white pubescence; ligule very short, membranous, lanceolate-acute.

Inflorescence of 4-5 (rarely 10-12) false spikes, distant, alternate, spreading, often drooping the upper slightly pedunculate, 5-10 cm. long, rhachis flattened, narrow, 1.5-2 mm. wide, sometimes flexuous, margins scaberulous. *Spikelets* 2-4-seriate, 3-3.5 mm. long, imbricate, broadly ovate-lanceolate plano-convex, long pubescent. *Lower glume* absent; upper glume 3-3.5 mm. long, concave, membranous, broadly ovate-lanceolate, acuminate, 5-nerved, glabrous on the back, very pubescent on the margins; hairs white, very slender, not swollen at the tips, not curled, .35-1.20 mm. long. *Lower floret* barren; lemma 2.7-3.2 mm. long, broadly ovate-lanceolate, acuminate, 7-nerved, pubescent. *Upper floret* hermaphrodite; lemma 1.6-2.5 mm. long, slightly convex, sub-cartilaginous, greenish, shining, scarcely punctate, striate, with margins slightly incurved; palea equalling the lower with the same texture, ovate-orbicular, back slightly convex, margins thin, recurved, with two flaps below the middle. *Stamens* linear; stigmas purple.

Introduced as a fodder grass and common in the hills.

14. PASPALIDIUM Stapf.

Spikelets ovate to ovate-oblong or ovate-lanceolate (in front view) awnless, convex to very convex on the back, flattened or slightly depressed on the face, turgid or dorsally moderately compressed, falling entire from the pedicels, solitary, secund, and abaxial on the triquetrous, sometimes herbaceous, marginate rhachis of slender sessile, spiciform racemes; lower floret male, with a usually well-developed palea or reduced to the lemma; upper floret hermaphrodite. *Glumes* mostly dissimilar and very unequal in length, the lower reduced to a small scale or up to (rarely over) half the length of the spikelet; upper mostly equalling the spikelet, 5-7-nerved with the nerves evenly distributed, rarely both

glumes much reduced. *Lower floret*; lemma similar to the upper glume with the inner side nerves more distant; palea if present only slightly shorter than the lemma with well-developed inflexed flaps. *Upper floret*; lemma oblong to elliptic in outline, acute to apiculate, emarginate, crustaceous, with firm involute margins, 5-nerved; palea almost as long as the lemma, 2-keeled, with its nodes slightly embraced by the lemma all along, of the same texture as the latter. *Lodicules* 2, small, broadly cuneate. *Stamens* 3. *Styles* distinct; stigmas plumose, laterally exserted from the top of the spikelet. *Caryopsis* more or less enclosed by the hardened lemma and palea.

Perennial, semi-aquatic or terrestrial grasses; blades linear, flat or involute, sometimes obtuse; ligules reduced to a ciliolate rim; racemes sessile or sub-sessile and secund on the alternate notches of a triquetrous common axis of a false compound spike, rigid, appressed or sub-appressed to the more or less hollowed out flanges of the latter; rhachis ending in a subulate point; spikelets mostly conspicuously 2-seriate and laterally contiguous, nearly always quite glabrous.

Key to the species of *Paspalidium*.

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|--------------------------------------|-----------------------------|
| Racemes longer than the internodes. | .. 1. <i>P. flavidum</i> . |
| Racemes shorter than the internodes. | .. 2. <i>P. punctatum</i> . |

1. *Paspalidium flavidum* A. Camus in Lecomte, Flor. Gen. de l' Indo-Chine VII. 419. Syn. *Panicum flavidum* Retz. Obs. IV (1786) 15.

Perennial (?). *Culms* 3-1.2 m. long, shortly decumbent at the base, then ascending, slender, somewhat compressed, glabrous. *Leaf-blades* 7.5-13 cm. long, by 3-7 mm. wide, ascending, somewhat rigid, linear-lanceolate, acute-acuminate at the summit, scarcely contracted at the base, flat or rolled, margins obscurely scabrous, glabrous, nerves obscure; sheaths longer than the internodes, compressed striate, glabrous or hairy on the throat, those of the lower leaves inflated; ligules absent or represented by a rim of hair.

Inflorescence a panicle of 6-9 false spikes, sessile, distant, erect or falciform, recurved, alternate, spikelets not very many; common axis triquetrous, glabrous, angles scaberulous; rhachis flattened, flexuous, with two rows of secund spikelets, closely imbricate, shortly produced beyond the last spikelet; pedicels very short. *Spikelets* 2-20, 1·8-3·5 mm. long, pale-greenish, ovate-oblong, somewhat acute, gibbous, glabrous; lower glume 9-17 mm. long, convex, membranous, ovate, sub-orbicular or cordate, clasping, obscurely 3-nerved; upper glume 1·25-2·6 mm. long, convex, membranous, rounded-ovate, sub-orbicular, clasping, 7-nerved. *Lower floret* male or neuter; 1·8-3·5 mm. long; lemma convex, sub-coriaceous, ovate-oblong or ovate-lanceolate, 3-nerved, embracing the upper floret, nervation distinct; palea membranous, ovate-oblong. *Upper floret* hermaphrodite, 1·5-3·2 mm. long; lemma strongly convex, coriaceous, broadly ovate, sub-orbicular, mucronulate, white or brownish, delicately foveolate, embracing the palea; palea coriaceous, ovate-oblong, delicately foveolate, with recurved margins. *Lodicules* quadrangular, very short.

Common in marshes in the plains. The seed can be eaten in times of want.

2. *Paspalidium punctatum* A. Camus in Lecomte, Flor. Gén. de l' Indo-Chine VII, 419. Syn. *Panicum punctatum* Burn. Fl. Ind. (1768) 26.

Perennial. *Culms* 6-1·2 m. long, floating and robust at the base, very spongy, rooting at the nodes, glabrous. *Leaf-blades* rigid or rather flaccid, linear-acute or acuminate, flat, narrow at the base, 10-30 cm. long, margins thickened, scabrid, nerves numerous, slender; sheaths long, lax, glabrous, those of the lower leaves inflated; ligule practically more or less reduced to a ring of hairs.

Inflorescence a panicle made up of distant, short false spikes, 15-22 in number, alternate, 1·5-4·5 cm. long, appressed to the rhachis. *Spikelets* numerous; common axis rather robust, furrowed; rhachis flattened, flexuous with scabrous margins, provided with two rows of secund spikelets and produced into a bristle beyond the uppermost spikelet. *Spike-*

lets 12-40, imbricate, pale, ovate-oblong, plano-convex, glabrous, 1·5-2·5 mm. long; lower glume ·7-1·2 mm. long, membranous, truncate, clasping; upper glume, ·7-1·2 mm. long; lemma almost flat, membranous, ovate-acute, 3-5-nerved; palea 0. *Upper floret* hermaphrodite, 1·5-2·5 mm. long; lemma strongly convex, coriaceous, ovate-lanceolate, acuminate, cuspidate, finely punctate, with margins slightly clasping the palea; palea flat, coriaceous, ovate-oblong, subcuspitate, finely punctate, with inturned margins. *Caryopsis* orbicular, compressed.

In marshes.

15. UROCHLOA. Beauv.

Spikelets broad ovate to elliptic or lanceolate-oblong awnless, usually more or less flattened or slightly depressed abaxially, convex on the back, falling entire from the pedicels, solitary or 2-nate, secund and abaxial on the more or less triquetrous, rarely strap-shaped, rhachis of moderately slender or somewhat stout, spiciform racemes; lower floret male or barren with a well-developed palea; upper floret hermaphrodite. *Glumes* similar and sub-equal or more often dissimilar or very unequal in length, the lower being the shorter, upper resembling, and more or less equalling, the lemma, with well-developed inflexed flaps and sharp, sometimes marginate, keels. *Upper floret*; lemma elliptic to rotundate-elliptic in outline, very obtuse with a usually scabrid or barbellate mucro, crustaceous with firm margins, narrowly involute, faintly 5-7-nerved; palea almost as long as the lemma, 2-keeled, tightly embraced by the lemma all along and of the same texture. *Lodicules* 2, broadly cuneate. *Stamens* 3, styles distinct; stigmas plumose laterally exserted. *Caryopsis* broadly to rotundate-elliptic, dorsally compressed, more or less flattened on both faces with broadly rounded sides; hilum sub-basal, punctiform. Perennials or annuals, blades linear to lanceolate, flat; ligules reduced to a ciliate rim; racemes sessile or sub-sessile on a common axis, simple or nearly so; rhachis more or less triquetrous, rarely strap-shaped; pedicels solitary or in pairs; spikelets close, continuous or slightly discontinuous, glabrous or hairy.

Urochloa panicoides Beauv. Ess. Agrost. 52 (1812) t. 11, fig. 1. **Syn.** *Panicum javanicum* Poir. Encycl. Suppl. IV (1816) t. 274.

A tufted annual, 30-60 cm. high. *Culms* erect or geniculately ascending from a short, sometimes rooting base slender, sparingly branched below, nodes slightly pubescent or almost glabrous. *Leaf-blades* lanceolate to linear-lanceolate, from a wide and semi-amplexicaul base 4-15 cm. long by 3-2-4 cm. wide, soft, flat, pale or yellowish-green, finely hirsute with tubercle-based hairs, rarely almost glabrous, margins crisped and undulate and more or less ciliate; sheaths somewhat loose, striate, densely ciliate upwards, more or less hirsute with tubercle-based hairs; nodes pubescent to sub-villous; ligules reduced to a densely ciliate rim.

Inflorescence of 4-7 erect or spreading, stiff or slightly flexuous, sessile or sub-sessile, spiciform, secund, racemes. *Common axis* flattened above, pubescent. *Racemes* moderately dense, 2-seriate, simple, 2-5.5 cm. long; rhachis flat or slightly wavy, triquetrons, flat on back, 1 mm. wide, villous at base glabrous upwards; angles scabrid, pedicels solitary, frequently bearing some long spreading hairs. *Spikelets* ovate- to elliptic-oblong, very acute, 4-5 mm. long, greenish, glabrous or pubescent. *Glumes* dissimilar; lower broad ovate, sub-obtuse to acute, clasping at the base, 1.5-2 mm. long; glabrous or sparingly and minutely pubescent, about 5-nerved, nerves anastomosing; upper glume corresponding in size and outline to the spikelet, prominently 8-11- (mostly 9-) nerved, glabrous or pubescent. *Lower floret* male or barren; lemma very similar to the upper glume but flat or slightly depressed, 5-7-nerved, glabrous and pubescent, very rarely with a lateral appressed fringe; palea oblong, acute, slightly shorter than the lemma. *Anthers* 2 mm. long. *Upper floret* hermaphrodite; rotundate-elliptic, greenish to pale-brown, 2.5-3 mm. long; lemma finely transversely rugose or granular, mucro up to 1 mm. long, sparingly barbellate. *Caryopsis* rotundate-elliptic in outline much compressed, 2 mm. long, yellowish or greenish.

Frequent on wet sand in the plains.

16. OPLISMENUS P. Beauv.

Spikelets oblong to ovate-oblong or lanceolate, awned from the glumes, falling entire from the pedicels, in small clusters on a common axis or 2-nate or solitary, secund and abaxial on the angular rhachis of racemosely arranged, densely or more rarely interruptedly, spiciform racemes; lower floret male or barren with a perfect or reduced or no palea; upper floret hermaphrodite. *Glumes* similar in shape and texture, sub-equal, herbaceous to membranous, 3-7-nerved, both, or at least the lower, awned, more or less keeled upwards. *Lower floret* exceeding the glumes; lemma resembling them, 5-9-nerved, muticous or mucronate or very shortly awned; palea sub-equal to the lemma and 2-nerved when perfect. *Upper floret*; lemma oblong, broadly involute with firm margins, muticous, chartaceous to sub-coriaceous; palea equalling the lemma and embraced by it all along. *Lodicules* 2, broadly cuneate, often delicate. *Stamens* 3. *Styles* distinct long; stigmas terminally or sub-terminally exserted, plumose. *Caryopsis* tightly enclosed by the somewhat hardened lemma and palea, oblong; hilum oblong $\frac{3}{4}$ - $\frac{1}{2}$ the length of the caryopsis.

Annual or more usually perennial often weak grasses with slender, many noded, ascending culms, the internodes of which have mostly a decurrent villous line adaxial to the subtending leaf; blades flat, thin, often slightly asymmetrical, often minutely cross veined; lower and intermediate racemes mostly distant; the awn of the lower glume the longest.

Key to the species of *Oplismenus*.

Spikelets in a false spike forming a panicle :—

Awns smooth, viscid, filiform. 1. *O. compositus*.

Awns barbellate, capillary; long, white hairs on the rhachis. 2. *O. burmannii*.

Spikelets fascicled on a simple terminal spike. 3. *O. undulatifolius*.

1. ***Oplismenus compositus* P. Beauv. Ess. Agros. (1812) 54.**

A perennial grass. *Culms* slender up to 1 m. long, ascending from a decumbent rooting base, terete, many noded, branched from the base, glabrous or frequently hairy along a

line adaxial to the supporting leaf. *Leaf-blades* lanceolate to linear-lanceolate from a constricted and distinctly rounded base, acuminate, 3·8-12·5 cm. long by 5 mm.-2 cm. wide, flat, thin, flaccid to rigid, dull green, minutely hairy to velvety below, sometimes with sparse white hairs above; sheaths markedly striate, densely ciliate along the margin, nodes usually pubescent, elsewhere glabrous; ligules short truncate, ciliate.

Inflorescence a panicle up to 18 cm. long, consisting of a series of secund or subsecund, spiciform racemes mostly distinct on a triquetrous rhachis varying from glabrous to hairy all over. *Racemes* decreasing in length upwards, the lowest 2·5-5 cm. long; rhachis flexuous, triquetrous, terminated by a spikelet, glabrous or sparingly hairy, bearded at the base; pedicels 2-nate or solitary, very short and stout, tip truncate, with a few bristles. *Spikelets* lanceolate to lanceolate-oblong, acuminate, 3·8-5 mm. long (excluding the awns) green to greenish, often with purple tips or tinged with red. *Glumes* sub-equal, 3·1 mm. long, thinly herbaceous-lanceolate to lanceolate-oblong in profile, produced into slender filiform, more or less viscous, purple awns, sparingly hairy, rarely quite glabrous; lower glumes 5-nerved, awn up to 12·5 mm. long; upper glume 7-9-nerved, awn 2·5-3 mm. long; if the spikelets are paired, only the lower glume has an awn. *Lower floret* barren equalling the spikelet; lemma similar to the upper glume apiculate, mucronate or with a very short awn, 9-nerved; palea very much reduced or 0. *Upper floret* hermaphrodite; oblong, acute 3·1 mm. long, whitish to brownish, polished; palea and lemma sub-coriaceous. *Caryopsis* dorsally compressed.

Very common in sal and other forests up to 6,000 ft.

2. *Oplismenus burmannii* P. Beauv. Ess. Agros. (1812) 54.

Annual. *Culms* very slender, up to 5 m. high, ascending from a long decumbent and rambling, rooting base, simple or more often branched upwards, branches short or barren or flowering, glabrous or hairy along a line adaxial to the supporting leaf. *Leaf-blades* lanceolate from a con-

stricted and slightly rounded base, acutely acuminate, 2-5 cm. long, 5 mm.-1·3 cm. wide, flat, thin and soft, loosely, but very sparingly, covered with long, white hairs, smooth, margins slightly scaberulous upwards; sheaths somewhat loose, prominently striate, ciliate along the margins and pubescent at the nodes, otherwise glabrous or more or less hairy; ligules very short, truncate.

Inflorescence a panicle consisting of 3-8, more or less secund, very dense, pale, spikelike racemes on a slender, triquetrous, glabrous or finely pubescent axis; lower racemes rather distant, erect or oblique, linear, the longest rarely over 1·6 cm. long; rhachis usually terminated by a spikelet, dorsally flat, fringed with silky hairs; pedicels 2-nate or solitary, short truncate. *Spikelets* contiguous, oblong, lanceolate, about 2·5 mm. long, one of a pair often imperfect. *Glumes* sub-equal, (upper slightly longer), 1·8-2 mm. long, thinly membranous to sub-hyaline, oblong in profile with capillary, slightly rough awns 2·5-10 mm. long, from a minute notch, ciliate and more or less pubescent; lower glume 3-nerved; upper 5-7-nerved. *Lower floret* barren; lemma lanceolate-oblong in profile, acuminate, produced into a very fine, short, capillary awn, 7-nerved, ciliate upwards and finely pubescent above the middle; palea 0. *Upper floret* hermaphrodite, oblong-acute, 2·5 mm. long, brownish, polished; lemma and palea papery, the former faintly 7-nerved. *Anthers* 1·25 mm. long. *Stigmas* moderately long, red. *Caryopsis* lanceolate-oblong, 2·5 mm. long, convex on the back, almost flat on the face, with a narrow oblong hilum almost half the length of the caryopsis.

A common grass of waste places in the plains.

3. Oplismenus undulatifolius P. Beauv. Ess. Agros. (1812) 54.

Perennial. *Culms* up to 60 cm. tall, ascending from a long, rambling base, often rooting at the nodes, simple or branched below, prominently striate or sulcate, internodes longer than the sheaths, glabrous or hairy along a line adaxial to the leaf concerned; nodes hairy. *Leaf-blades* linear-lanceolate to ovate-lanceolate, base tapering to

its insertion on the sheath, rounded, tapering to a point, surface often covered with long soft hairs or glabrous, smooth or rough, margin scarcely thickened, scabrid; leaf-sheaths rather loose, striate, finally shorter than the internodes, glabrous or with long soft, white hairs from tubercle bases, densely ciliate along the margins, 6-15 cm. long, 1-1.5 cm. wide.

Inflorescence a spike consisting of a central axis upon which are spaced small fascicles of spikelets. *Axis* triquetrous subacute, angles hirsute especially towards the top. *Spikelets* in clusters of from 1-6, sessile, of which several may be imperfect or seated upon very short, hairy pedicels. Perfect spikelets lanceolate, 3.5 mm. long, awned, more or less hairy and rough. *Lower glume* ovate-obtuse, 5-nerved, 2 mm. long, long awned from below the tip; awn up to 1.8 cm. long; upper glume little longer than the lower, short awned; lower floret barren, minutely paleate or epaleate; lemma equalling the spikelet in length, ovate-acute in shape, 7-9-nerved, hairy along the nerves, scabrid in between; the margins clasping the upper floret; upper floret hermaphrodite; lemma elliptic-mucronate, 3 mm. long, margins flat, clasping the palea, smooth, shining, white, sub-coriaceous, translucent; palea of the same substance as the lemma and as long, margins infolded. *Stigmas* 2, long exserted.

Hardly more than a state of *O. compositus* Beauv. Rather uncommon. Found in the hill forests 2-4,000 ft.

17. PSEUDECHINOLAENA Stapf.

Spikelets obliquely ovoid, laterally compressed and mostly conspicuously gaping, falling entire from the pedicels, 2-nate or more often sub-solidary (the second of the pair more or less arrested) or solitary, secund on the flat or triquetrous slender rhachis of spiciform, racemosely arranged racemes; lower floret male or barren; upper floret shorter than the lower, hermaphrodite. *Glumes* herbaceous, about equal, long or almost as long as the spikelet, or the lower distinctly shorter, heteromorphous; lower more or less flat, 3-nerved, always smooth or nearly so, upper boat-shaped, gibbous downwards, 7-nerved, with longitudinal rows of more or less transparent "glands" between the nerves and with

or without, shorter or longer, stout hooked hairs or bristles from the centre of the spots. *Lower floret* as long as the spikelet; lemma oblong-lanceolate with a minutely truncate tip, laterally compressed but rounded on the back, chartaceous with membranous margins and a delicate hyaline area at the base, smooth; palea almost as long as the lemma, more or less convolute, faintly 2-nerved. *Upper floret*; broad lanceolate to oblong, sub-acute, very convex on the back, chartaceous, faintly 5-nerved; palea similar to the lemma in texture, tightly clasped by it when mature. *Lodicules* 2, cuneate. *Stamens* 3. *Styles* free at the base, capillary; stigmas plumose, sub-terminally exserted. *Caryopsis* oblong in face-view, semi-ovoblate in profile, back very convex, scutellum elliptic, almost half the length of the grain; hilum subbasal; punctiform.

Perennials with very slender culms from a prostrate rooting base; leaf-blades lanceolate, soft; spikelets very irregularly armed or quite unarmed.

Pseudechinolaena polystachya *Stapf.*, in *Flor. Trop. Afric.* IX. 495. Syn. *Panicum uncinatum* Raddi, *Agrost. Bras.* (1823) 41.

Perennial. *Culms* rooting and branching at the base, finally ascending, slender, pubescent at the nodes. *Leaf-blades* thin, flat, spreading, ovate-lanceolate, acuminate, nerved at the base, oblique, with scattered hairs on the surfaces and tubercled-based hairs at the base, 5-10 cm. long, nerves faint; margins scarcely scabrid; sheaths pubescent with ciliate margins; ligules short, membranous-scarious, truncate.

Inflorescence a narrow panicle 4-20 cm. long; rhachis slender, smooth; branches 2-6, separate, erect, filiform, flexuous, spiciform, scaberulous, the lower 2-3 cm. long the upper shorter; pedicels very short, scabrid. *Spikelets* 4-5 mm. long, erect, dimidiate-ovate, compressed laterally, 1-2-nate, with a glume like branch at the base of the pedicel, often reduced on the lower branches of the panicle to lanceolate or subulate glumes; lower glume 4-2-4-5 mm. long, oblong-lanceolate, acuminate, keeled, 3-nerved, glabrous or with silky hairs towards the summit, often scabrid; upper glume 4-5 mm.

long, herbaceous, with broadly membranous margins, gibbous, ovoid, cymbiform, acute or acuminate, obscurely 7-nerved, reddish, glandular, often hispid, with hooked hairs. *Lower floret* male; lemma 4·3-4·5 mm. long, coriaceous, margins thin, broadly ovate obtuse, 7-nerved, palea 4·3-4·5 mm. coriaceous, lanceolate, finely acuminate, margins involute. *Upper floret* hermaphrodite, sessile; lemma 3·5-3·7 mm. long, cymbiform, oblong-lanceolate, acute or acuminate, shining, smooth, white, coriaceous, compressed laterally, rounded on the back, margins strongly incurved; palea narrow, of the same texture as the lemma.

Common all over the province. It is essentially a forest grass.

18. ERIOCHLOA H. B. K.

Spikelets ovate-lanceolate to oblong, acute or acuminate, sometimes finely shortly aristulate, slightly compressed from the back, falling entire from the pedicels, 2-nate or solitary, secund and adaxial on the triquetrous rhachis of more or less spiciform, simple or compound, racemosely arranged racemes; lower floret male or barren; upper floret hermaphrodite. *Glumes* very unequal, the lower reduced to a minute cupular rim clasping the thickened, beadlike, lowest internode of the spikelet; upper corresponding in outline and size to the spikelet, sometimes shortly aristulate, membranous faintly 5-nerved, the sub-marginal nerves sometimes obscure. *Lower floret*; lemma very like the upper glume, if not slightly shorter; palea sub-equal to the lemma, 2-keeled or reduced, or suppressed. *Upper floret*; lemma chartaceous to almost crustaceous, glabrous or very minutely puberulous at the apex, faintly 5-nerved, with a fine, barbellate mucro of varying length; palea equal to the lemma, 2-keeled, with narrow flaps. *Lodicules* 2, broadly cuneate. *Stamens* 3. *Styles* distinct, stigmas laterally exerted near the tips of the spikelets. *Caryopsis* enclosed in its floret and the tightly appressed lower floret and upper glume, dorsally compressed; hilum sub-basal, punctiform.

Perennials or annuals. *Leaf-blades* more or less flat, ligules reduced to a ciliate rim. *Racemes* peduncled or the upper sub-sessile, racemosely arranged in a narrow panicle.

Eriochloa procera C. E. Hubbard in Kew Bull. 1930.
256. Syn. *E. polystachya* H. B. & K. Nov. Gen. et Sp. I (1815) 95.

A perennial grass with fasciculate fibrous roots and a short creeping rhizome. *Culms* 3-1.5 m. tall, densely tufted, simple or branched, erect or decumbent at the base, often geniculate, glabrous, swollen and pubescent at the nodes, striate. *Leaf-blades* erect, linear or linear lanceolate, acuminate, flat, soft, striate, glabrous, 9.5-25 cm. long, smooth or with scarcely scabrid margins; sheaths open, compressed, sub-carinate, glabrous or not, striate, the upper the longer; ligule very short, hairy.

Inflorescence a panicle made up of simple or branched spikes, erect or not, 5-13 cm. long, in a simple panicle, or very short in a branched panicle; rachis slender, angular, quite smooth; branches often bare at the base; pedicels solitary or 2-nate, the longer shorter than the spikelet, triquetrous, swollen at the apex and carrying silky hairs. *Spikelets* very laxly imbricate, erect, 2.5-3.5 mm. long, ovate-lanceolate, acuminate compressed, velvety, with hairs at the summit, which are rigid, erect, not capitate, 3-4 mm. long. *Lower glume* absent; upper glume 2.5-3.5 mm. long, membranous, convex, ovate-lanceolate, acuminate, with the margins somewhat inrolled, 3-5-nerved, silky. *Lower floret* sterile; lemma 2.3-3.2 mm. long, flatter, otherwise similar to the upper glume; palea absent. *Upper floret* hermaphrodite; lemma 1.5-1.8 mm. long, subcoriaceous, pale, shining, compressed dorsally, oblong-obtuse, sub-convex, margins narrowly inflexed and embracing the palea, with a few hairs at the top, continued into a mucro with short rigid erect hairs; palea a little shorter than the lemma; oblong, obtuse, almost flat with inflexed margins. *Caryopsis* free within the hardened lemma and palea, pointed at the base, obtuse above, compressed lenticular, smooth.

Common in marshes in the plains.

19. AXONOPUS Beauv.

Spikelets elliptic-oblong to oblong or lanceolate, depressedly biconvex, falling entire from the rudimentary pedicels,

solitary, secund and adaxial on the triquetrous, or more or less flattened rhachis of very slender spikes or spikelike racemes; lower floret barren, reduced to the lemma; upper floret hermaphrodite. *Glumes*; the lower suppressed, the upper equal to the spikelet, membranous, very finely or faintly 5-4-nerved. *Lower floret*; lemma very similar to the upper glume, with the nerves still finer and the middle nerve often absent. *Upper floret*; lemma chartaceous, to crustaceous, with firm margins, obtuse, emucronate, faintly 4-nerved; palea equal or sub-equal to the lemma and similar in substance, tightly embraced by the narrowly involute margins of the lemma. *Lodicules* 2, minute, broadly cuneate. *Stamens* 3. *Styles* distinct; stigmas laterally exserted near the tip of the floret. *Grain* tightly enclosed by the slightly hardened lemma and palea, elliptic, dorsally much compressed, flat on both sides; hilum sub-basal, punctiform; embryo less than half the length of the grain :

Stoloniferous or caespitose perennials; blades more or less linear, flat or folded or involute; ligules very narrow, membranous; spikes 2 or more, often very many, digitate or sub-digitate, if many then usually crowded on a short common axis, sessile, simple, spikelets usually small to very small, and closely appressed to the rhachis which is sometimes chambered by the rudimentary pedicels and then widened insertions from cross bars running from the facial angle to the margin.

Axonopus compressus (Sw.) Beauv. Ess. Agros. (1812) 154.

A perennial grass. *Culms* often erect but more usually ascending from a geniculate base, tufted, slender, glabrous, smooth, seated on a slender rhizome; stolons creeping and rooting. *Leaf-blades* linear-lanceolate to linear from a more or less rounded base, obtuse or shortly acute, 5-12 cm. long, 5-15 mm. wide, folded or flat, bright green, quite glabrous or rigidly ciliate, rarely loosely hairy all over, midrib and primary laterals very slender, but quite distinct below; leaf-sheaths compressed and keeled, crowded and flabellate, gla-

brous or sparingly hairy, striate and smooth; ligules a narrow membranous rim, minutely ciliolate.

Inflorescence of 2-3-5 sub-digitate, sessile, erect or spreading racemes; common axis very slender angular glabrous, if three or more spikes, the lowest internode often over 2·5 cm. long. *Spikes* very slender 5-7·5 cm. long; rhachis straight or flexuous if long, about .75 mm. wide, triquetrous, angled and narrowly winged, angles scaberulous or almost smooth; pedicels alternately to left and right of the frontal angle, reduced to smooth elliptic sub-sessile discs. *Spikelets* oblong to lanceolate-oblong, sub-acute to acute, 2-2·5 mm. long (in Assam specimens). *Lower glume* absent; the upper the shape of the spikelet with narrowly incurved margins, membranous on the back, papery on the margins, 4-5-nerved, bearing 4 lines of very fine hairs, sometimes hairs scanty or inner lines absent. *Upper floret* hermaphrodite, much shorter than the spikelet, elliptic-oblong, obtuse, white; lemma and palea thinly crustaceous, the former very faintly 4-nerved, finely and shortly hairy at the top. *Grain* elliptic in outline, obtuse, white; scutellum rotundate elliptic, not reaching the middle of the grain.

This species is quite common in LAKHIMPUR District, especially about Tinsukia in Dibrugarh. It is considered an excellent pasture grass and forms a mat when regularly grazed. Known as "Carpet Grass." It prefers low lying, clayey, water logged conditions.

20. BRACHIARIA Griseb.

Spikelets oblong to ovate, broadly elliptic, obovate-elliptic or elliptic-oblong, awnless, usually more or less flattened and slightly depressed, convex on the back, falling entire from the pedicels, 1-2-nate, more rarely in fascicles of 3 or more, secund and adaxial on the triquetrous or flat rhachis of moderately slender or stout, mostly spiciform racemes. *Glumes* dissimilar and mostly very unequal in length, the lower being the shorter, upper resembling and more or less equalling the lemma of the lower floret, 5-7-(very rarely 9-) nerved with the nerves evenly distributed. *Lower floret* male or barren with a usually well-developed palea, very rarely the latter suppressed; lemma 5-, very rarely 7-nerved, lateral nerves near margin; palea usually only slight-

ly shorter than the lemma with well-developed inflexed flaps. *Upper floret* hermaphrodite; lemma oblong to elliptic in outline, emarginate, though sometimes contracting into a small projecting point, more or less crustaceous or sub-coriaceous with firm margins, narrowly involute, faintly 5-nerved; palea almost as long as the lemma, 2-keeled, its side lightly embraced by the lemma all along and of the same texture. *Lodicules* 2, small broadly cuneate, stamens 3, styles distinct, stigmas plumose, laterally exserted from the top of the spikelet. *Caryopsis* tightly enclosed by the hardened lemma and palea.

Perennial or annual. *Leaf-blades* linear to lanceolate, usually flat; ligules reduced to a narrow ciliate or ciliolate rim; racemes usually sub-sessile and solitary on a common axis, simple or compound near the base; rhachis filiform, triquetrous to more or less flattened; pedicels solitary or in pairs; spikelets usually closely appressed.

Key to the species of *Brachiaria*.

- Spikelets densely crowded, in more than 2 rows, 2·5-3 mm. long, sheath nodes usually long bearded, culms stout, rhachis flattened. 1. *B. mutica*.
 Spikelets loose or if crowded less than 2·5 mm. sheath-nodes glabrous or pubescent; culms slender.
 Lower glume at least 2/3 length of spikelet. 2. *B. paspaloides*.
 Lower glume up to 1/3 length of the spikelet.
 Spikelets 1·8-2·5 mm. long; rhachis triquetrous.
 Panicle linear with erect racemes, rhachis pubescent. 3. *B. eruciformis*.
 Panicle lanceolate to oblong with spreading racemes; rhachis with scattered hairs.
 Spikelets solitary 1·8-2·5 mm., often densely hairy as well as rhachis and pedicels, upper lemma ovate-oblong. 4. *B. villosa*.
 Spikelets paired or upwards solitary, 1·25-1·8 mm. long; hairs on the spikelets longer than spikelet, upper lemma obovate or elliptic. 5. *B. reptans*.
 Spikelets 2·5-4 mm. long, rhachis triquetrous or flattened.
 Spikelets turgid, broadly elliptic or broadly obovate-elliptic, apiculate. . . . 6. *B. ramosa*.

Spikelets not turgid.

Spikelets ovate to lanceolate, paired
in the lower part of the racemes;
rhachis hairy.

7. *B. setigera*.

Spikelets elliptic to obovate, rhachis
glabrous.

Spikelets elliptic, widest at or just
below middle, sharply acute,
rhachis glabrous.

Spikelets 3·5-4 mm. long. 8. *B. subquadripala*.

Spikelets 2·5 mm. long. 9. *B. kurzii*.

Spikelets obovate or obovate-ellip-
tic., obtuse or shortly acute.

Spikelets 3·5-4 mm. long, race-
mes 3 or more, peduncle glab-
rous, rarely puberulous, leaves
1·5-6·5 cm. long. 10. *B. miliiformis*.

Spikelets 2·5-3 mm. long, race-
mes 2-3(4); peduncle below
inflorescence hairy; leaves
7·5-16 cm. long. 11. *B. distachya*.

The following three species are very closely related and difficult of discrimination. Their characteristics are set out in more expanded form to aid identification.

Brachiaria distachya (L.) A. Camus.

Spikelets 2·5-2·8 mm., obovate-ovoid, gradually narrowed below, greatest width distinctly above the middle, rather abruptly acuminate, apiculate; lower glume 1 mm. long. Racemes often 2, sub-conjugate.

Brachiaria subquadripala (Trin.) Hitch.

Spikelets 3·5-4 mm., lanceolate-oblong, greatest width just at the middle, not abruptly acuminate, nor apiculate, acute only; lower glume 2 mm. long. Racemes 3-4 or more never conjugate.

Brachiaria miliiformis Chase.

Spikelets obovate, elliptic-obovate or oblong-obovate, plump, with a shortly acute or apiculate or somewhat obtuse apex.

I. *Brachiaria mutica* Stapf, in Flor. Trop. Afr. IX (1934) 526. Syn. *Panicum muticum* Forsk. Flor. Aegypt. Arab. (1775) 20.

Perennial with well-developed root. Culms 6-2·4 m. rooting, branched, robust, geniculate at the base, then ascending, slender and bare at the top, compressed, striate, glabrous; nodes covered with long white hairs; leaves spreading, linear

or linear-lanceolate, acuminate, sub-cordate at the base, flat, glabrous or slightly hairy on the under-surface, scaberulous, 15-25 cm. long, 1·25-1·6 cm. wide, margins hispid; sheaths compressed, striate, lax, glabrous or hairy at the throat; ligules short, very hairy.

Inflorescence a panicle made up of 8-20 false spikes or racemes, simple or compound at the base, erect or somewhat spreading, alternate, distant, robust, lower 5-10 cm., the upper shorter; principal axis almost rounded, angular at the summit, almost straight, striate, glabrous; rachis of the racemes striate, back convex, ciliate on the margins and with a few long hairs at the base. *Pedicels* short, paired, solitary or fascicled with numerous spreading hairs. *Spikelets* green or violet, crowded, ovate-acute, 2·5-3 mm.; glabrous, lower glume 6-1 mm., membranous, concave, ovate-acute, 1-nerved, upper glume 2·5-3 mm., membranous, concave, ovate-acute, 5-nerved. *Lower floret* male or occasionally neuter; lemma 2·4-2·7 mm. long, almost the same as the upper glume but flatter and not so definitely nerved; palea 2·2-2·7 mm. long, narrower than the lemma, hyaline, 1-nerved. *Stamens* shorter than the lemma, filaments very short, anthers purple. *Upper floret* hermaphrodite, 2-2·5 mm. long, sub-sessile; lemma pale, convex depressed on the back, sub-coriaceous, oblong or elliptic, obtuse, pitted; mucro almost absent; margins hardly incurved; palea sub-coriaceous, back flat, pitted elliptic, obtuse, margins inturned.

Grown as a valuable fodder grass in many parts of the tropics and has been introduced into ASSAM.

2. **Brachiaria paspaloides** (*Presl*) C. E. Hubbard.
Hook. Ic. Pl. sub tab. 3363. Syn. *Urochloa paspaloides* Presl,
Rel. Haenk. I (1830) 318; *Panicum ambiguum* Trin. in Mem.
Acad. St. Petersh. ser. 6. Sci. nat. III (1835) 243.

Annual. *Culms* 15-75 cm., branched, rooting at the base, slender, pubescent at the summit and at the nodes, internodes long. *Leaf-blades* linear, acuminate, contracted and rounded at the base, narrow, flat, more or less hairy on both surfaces, 7·5-15 cm. long by 4-5 mm. wide, smooth above, scaberulous below and on the margins; median nerves slender; sheaths

open, narrow, glabrous or hairy; margins ciliate below the middle; ligule a tuft of hairs.

Inflorescence a panicle made up of 3-4, rarely 6-7 false spikes, sub-erect, sub-sessile, slender, 2·5-6 cm. long; principal axis of the panicle triquetrous, scaberulous, glabrous or with a few hairs at the nodes; rhachis of racemes round, with ciliate margins; pedicels pubescent. *Spikelets* greenish, sub-erect, laxly biseriate, imbricate, oblong-ovate, acuminate, compressed, glabrous, 3·4·5 mm. long. *Lower glume* 3·4·2 mm. long, almost flat, clasping, membranous, ovate-acute, with five green nerves; upper glume 3·4·5 mm. long, convex, membranous, ovate-lanceolate, acuminate, 7-nerved. *Lower floret* male or neuter; lemma 2·3·5 mm. long, almost flat, membranous, ovate-lanceolate, acuminate; palea very short or 0, membranous. *Upper floret* hermaphrodite, slightly stipitate, 2·3·5 mm. long; lemma convex, slightly flattened dorsally, sub-coriaceous, elliptic-oblong, summit obtuse, aristulate, sometimes delicately pitted, obscurely 5-nerved, margins embracing the palea; crest hidden by the lower lemma and the upper glume, scaberulous, palea subcoriaceous, or sub-elliptic, delicately pitted, with the margins strongly infolded.

GOALPARA, rare.

3. *Brachiaria eruciformis* Griseb. in Ledeb. Fl. Ross. IV (1833) 469. Syn. *Panicum isachne* Roth, Nov. Pl. Sp. (1821) 54.

Annual. *Culms* 30-60 cm. high, loosely tufted, geniculately ascending from a sometimes decumbent and rooting base, slender, much branched below, terete or slender, glabrous. *Leaf-blades* linear-lanceolate, base rounded, acute, 2-6 cm. long by 2-5 mm. wide, flat or convolute, rigid, glabrous or hairy, margins very scabrid; sheaths rather tight, terete or sub-terete, striate, softly hairy or glabrous except at the villous nodes; ligules reduced to a dense fringe of hairs.

Inflorescence of secund or sub-secund, very narrow racemes, 2-10 in number, usually appressed to the filiform, scabrid axis, which is terete below and flattened upwards; racemes simple, dense, 1·25-2·5 cm. long; rhachis

filiform, triquetrous, straight or slightly wavy, scabrid or ciliate; pedicels solitary, very short, scabrid, tips thickened. *Spikelets* 2-seriate, imbricate, oblong, obtuse or subacute, flat on the back, 2·2-5 mm. long, softly pubescent. *Glumes* very unequal; lower a truncate, hyaline scale ·3 mm. long, rarely ·5 mm. long, 1-nerved; upper membranous, corresponding in outline and size to the spikelet, 5-nerved, minutely hairy. *Lower floret* neuter or rarely male; lemma very similar to the upper glume, faintly 5-nerved; palea very obtuse, subequal to the lemma in male, reduced in neuter florets. *Upper floret* hermaphrodite, elliptic-oblong, obtuse, 1·5-1·6 mm. long; lemma and palea thinly crustaceous, shining, whitish or at length brownish, finely granulate. *Anthers* 1 mm. long. *Caryopsis* oblong, elliptic or obovate-oblong, 1·1-1·5 mm. long, more or less flattened on both sides, mainly on the back, olive green.

In marshes in the plains.

4. Brachiaria villosa A. Camus in Lecomte, Flor. Gen. de l' Indo-Chine, VII 433. Syn. *Panicum villosum* Lamk. Illus. I (1791) 173.

Annual. *Culms* 20-40 cm. high, rooting at the base, somewhat slender, softly hairy, glabrous at the top, with numerous nodes, velvety. *Leaves* spreading, ovate or ovate-lanceolate, acute at the summit, rounded at the base, thin, 1·4 cm. long, softly pubescent on the 2 surfaces; margins white, denticulate, ciliate; nerves well-marked; sheaths shorter than the internodes, hairy; ligule a ring of hairs.

Inflorescence a panicle made up of 5-10 racemes, upright or somewhat spreading, alternate, sessile or sub-sessile, rather distant, 6-15 mm. long, the upper shorter; axis triquetrous, pubescent; rhachis more slender; pedicels short, silky. *Spikelets* crowded, biseriate, ovate-apiculate, pubescent, 2·5 mm. long; lower glume ·7 mm. long, membranous clasping, ovate-orbicular, 1-3-nerved, hispid; upper glume 1·5-2·5 mm. long, membranous, convex, ovate, sub-acute, 5-7-nerved, hispid. *Lower floret*; lemma up to 2·5 mm. long, like the upper glume but flatter; palea hyaline, flat, linear-oblong, shorter than the lemma. *Upper floret* hermaphrodite, 2·3

mm. sub-sessile; lemma pale, very convex, coriaceous, ovate or ovate-oblong, acute or shortly apiculate, delicately pitted, with margins narrowly incurved; palea coriaceous, back flat, ovate-oblong or elliptic-oblong, acute, often shortly apiculate, delicately pitted, margins much incurved.

Common in the NAGA, KHASI & JAINTIA HILLS. 2-6,000 ft.

5. Brachiaria reptans (L.) Gardner et Hubbard, in Hook. Ic. Pl. sub tab. 3363. Syn. *Panicum reptans* Lamk. Illus. I (1791) 171.

An annual or perennial grass. *Clums* 10-45 cm. long, creeping, rooting and sometimes branching at the base, slender, almost compressed, striate, glabrous, with pubescent nodes. *Leaves* spreading, rather numerous, ovate-lanceolate, lanceolate or cordate-lanceolate, acuminate, amplexicaul, thin, flat, 2·5-6·5 cm. long, ·8-1·5 cm. wide, glabrous or with a few scattered hairs, scaberulous above, margins thickened, whitish, hispidulous; sheaths slightly compressed, striate, longer than the internodes, open, broad, glabrous, margins pubescent.

The panicle is made up of 5-9 racemes, at first erect, then spreading, alternate, sub-sessile, 1·5-3 cm. long; panicle-axis angular, scaberulous; rhachis of racemes similar, narrower than the spikelet, hispidulous on the margins, pubescent at the base; pedicels short, solitary or 2-nate, pubescent, often (always?) with long, white hairs enveloping the spikelet. *Spikelets* pale, crowded, ovate-acute or ellipsoid, glabrous, 1·2 mm. long; lower glume ·4-·7 mm., membranous, clasping, ovate-cordate, slightly obtuse without nerves or 1-3-nerved; upper glume 1-2 mm. long, membranous, concave, ovate-acute, strongly 5-7-nerved. *Lower floret*; lemma equal and similar to the upper glume but flatter and broader, 5-nerved; palea, hyaline, oblong acute or obtuse, distinctly 2-nerved. *Upper floret* hermaphrodite, ·7-1·7 mm. long, shortly stipitate, lemma pale, convex, coriaceous, ovate or obovate-elliptic, obtuse or shortly apiculate, foveolate rugose, with margins embracing the palea; the latter coria-

ceous with a flat back, foveolate, obovate or elliptic with inturned margins.

Common in the plains. The seed can be eaten.

6. Brachiaria ramosa Stapf, in *Flor. Trop. Afr.* IX. 542. Syn. *Panicum ramosum* Linn. Mant. I (1767) 29.

Annual, up to 60 cm. high. *Culms* fascicled, slender, geniculate, sub-erect or ascending from a prostrate and rooting base, terete, branched below, glabrous or finely pubescent. *Leaf-blades* linear-lanceolate from a rounded, often clasping base, finely acuminate, 5-12.5 cm. long, .6-1.6 cm. wide, soft, flaccid, glabrous or finely pubescent; margins sharply scabrid; sheaths thin, loose below, finely striate, glabrous, or with a few marginal cilia near the mouth, or finely pubescent all over; ligules a line of short white hairs.

Panicle narrowly oblong, 5-15 cm. long, of 5-many racemes; common axis angular, channelled, scabrid on the edges, glabrous or finely pubescent with here and there longer hairs, terminating in a spikelet. *Racemes* 3.5 cm. long, upper gradually shorter, straight or slightly flexuous, simple or the longer compound; rachis triquetrous, slightly wavy to straight, scabrid on the angles, glabrous on the angles, glabrous or finely pubescent, with or without scattered long hairs; pedicels paired or fascicled or upwards solitary. *Spikelets* ovoid, sub-acute or apiculate, somewhat turgid, 3 mm. long, greenish, at length pale, or straw-coloured. *Glumes* unequal; lower broadly ovate-obtuse to sub-acute, clasping at the base 5-7-(rarely 3-) nerved; upper corresponding in size and shape to the spikelet, membranous, glabrous or finely pubescent, 7-(more rarely 5-) nerved, nerves distinct. *Lower floret* neuter, lemma similar to the upper glume, 5-nerved; palea oblong, truncate, delicate, more or less reduced. *Upper floret* hermaphrodite; slightly shorter than the lower, ovate in outline, sub-acute, pale brown when mature; lemma and palea crustaceous transversely rugose. *Caryopsis* broad-elliptic in outline, flat or slightly depressed on both sides up to 2 mm. long.

Occasionally found in the plains.

7. *Brachiaria setigera* (Retz.) C. E. Hubbard in Hook. Ic. Pl. sub tab. 3363. Syn. *Panicum setigerum* Retz. Obs. Bot. IV (1786) 15.

Perennial up to 1 m. high; innovations extravaginal with long thin pubescent cataphylls. *Culms* ascending from a prostrate, straggling base, simple or sparingly branched. *Leaf-blades* lanceolate from a rounded or sub-cordate and semi-amplexicaul base, tapering to an acute point, up to 15 cm. long, 2·5 cm. wide, flat, slightly rigid, pale green, glabrous and smooth on the surface; margins scabrid, undulate or crisped, long ciliate to the rounded base; sheaths tight, smooth and glabrous or with a few tubercle based hairs, margins densely villously ciliate, nodes pubescent to silky bearded; ligules reduced to a densely ciliate rim.

Inflorescence a panicle, long exserted, made up of 4-7 obliquely erect and spreading sessile or sub-sessile, spiciform, secund racemes; common axis slender 5-7·5 cm. long, semi-terete below, flattened upwards, scaberulous on the angles, glabrous or with a few scattered hairs. *Racemes* moderately dense to almost loose, lower 5 cm. long; upper shorter; rhachis almost straight, rather flat, 2-4 mm. wide, hairy at the base, angles scabrid; pedicels reduced to sub-terete stumps, the longer of a pair up to 1·5 mm. long, usually a few bristles on the pedicels. *Spikelets* ovate-lanceolate, acutely acuminate, 5 mm. long, usually pubescent. *Lower glume* membranous, broadly-ovate, clasping at the base, acute, 1·5 mm. long, 3- sub 5-nerved; upper glume membranous, corresponding in shape and size to the spikelet, prominently 7-9-nerved. *Lower floret* barren; lemma very similar to the upper glume, somewhat flat on the back, 5-nerved; palea broad-oblong, acuminate, somewhat shorter than the lemma. *Upper floret* hermaphrodite, broad to rotundate-elliptic in outline, 2·5 mm. long, pale, very delicately wrinkled or granulate; lemma with a scaberulous mucro, up to ·9 mm. long. *Anthers* 3, 1 mm. long.

GOALPARA.

8. *Brachiaria subquadripala* (Trin.) Hitch. in Lingnan Sc. Jour. VII (1929) 214. Syn. *Panicum subquadripa-*

rum Trin. Gram. Panic. (1826) 145; Gram. Icon. (1829) 186.

An annual. *Culms* up to 45 cm. tall, finally erect from a creeping and rooting base, creeping extensively, very leafy almost to the base of the panicle, smooth and glabrous. *Leaf-blades* lanceolate-acuminate, 3-9 cm. long, 4-9 mm. wide, spreading, flat, margins often crisped, base rounded, almost amplexicaul, surfaces of the lamina glabrous or with scattered, stiff, appressed, white hairs, smooth or scabrid on the surfaces; margins always very scabrid; sheaths rather loose, usually slipping from the culms, markedly striate, margins densely ciliate, glabrous or hairy, smooth or scabrous; ligules a rigid of stiff white hairs.

Inflorescence a panicle of 4-6 racemes. 2-5-4 cm. long, rhachis flattened, glabrous; margins scabrid. *Spikelets* solitary on very short scabrid pedicels, glabrous, lanceolate-oblong, acute, greatest width just at the middle. *Lower glume* 2 mm. long, over 2 mm. broad, 7-nerved, clasping the base of the spikelet; upper glume 3.75 mm. long, membranous, oblong, acute, 7-nerved; lower floret neuter; lemma corresponding in size, shape and texture to the upper glume; palea reduced, hyaline. *Upper floret* hermaphrodite; 3 mm. long, seated on a thickened stipe; elliptic in outline, subcoriaceous or chartaceous, finely striate, punctate and transversely rugose, margins securely clasping the palea; palea of same texture and shape as the lemma, slightly smaller.

Plains of DARRANG.

9. Brachiaria kurzii A. Camus. in Lecomte, Flor. Gen. de l'Indo-Chine, Vol. VII, 438. Syn. *Panicum kurzii* Hook. f. F. B. I. VII (1897) 38.

An annual. *Culms* erect, decumbent and rooting at base. *Leaves* lanceolate, acuminate, cordate at the base, 5-8 cm. long, 8-18 mm. wide; margins crisped, long ciliate at the base and shortly so at the apex; sheaths with ciliate margins; ligules bearded.

Inflorescence composed of a few false spikes, 5-7.5 cm. long, very slender, distant, glabrous or nearly so; rhachis scabrous, bearing a few long hairs. *Spikelets* pale, sub-

sessile or pedicelled, ovate-acute, 2·5 mm. long glabrous; lower glume 1·8-1 mm. long, ovate, sub-obtuse, clasping, 3-5-nerved; upper glume 1·25 mm. ovate-acuminate, 7-nerved. *Lower floret* male or neuter; lemma 2·3 mm. long, ovate, acute, 5-7-nerved; palea 2·2 mm., pale, whitish, rather thick, rounded, oblong or sub-elliptic. *Upper floret* 2·25 mm. long, cartilaginous, rugose, elliptic-oblong, summit rounded and apiculate, with clasping margins; palea scarcely shorter than the lemma, cartilaginous, slightly angular.

Rare. So far only found at the foot of the GARO HILLS.

10. Brachiaria miliiformis (Presl) A. Chase, in Contrib. U. S. Nat. Herb. XXII (1920) 35. Syn. *Panicum miliiforme* Presl, Rel. Haenk. I (1830) 300.

Culms up to 80 cm. long, decumbent at the base and rooting, smooth and glabrous, slender, often branching below. *Leaf-blades* lanceolate 7-16 cm. long, acuminate, many nerved, glabrous, rarely with a few hairs; margins very scabrid, often a few cilia on the rounded base; sheaths striate, glabrous or sparsely hairy, margins densely ciliate, close, terete, a few hairs on the throat; ligule a ridge of dense white hairs.

Panicle made up of from 4-6 racemes. *Spikelets* solitary, rhachis flattish, striate and convex on the back, margins scabrid; pedicels of spikelets short, about $\frac{1}{4}$ the length of a spikelet, distinct from one another, more or less scaberulous. *Spikelets* glabrous, elliptic, or elliptic-ob lanceolate, acute, usually apiculate, rather plump, 3-4 mm. long. *Lower glume* membranous, wider than long, 2 mm. long, clasping the spikelet at the base, many nerved; upper glume membranous, corresponding in length and shape to the spikelet, 7-nerved. *Lower floret* neuter; lemma very similar to the upper glume in texture, shape and size, 5-nerved; palea oblong, hyaline, 2-nerved. *Upper floret* hermaphrodite; lemma elliptic, rather obtuse, 5 mm. long, coriaceous to crustaceous when mature; obscurely 3-nerved, vertically striate, minutely punctate, margins narrowly infolded embracing the palea; palea of the same texture as the lemma. *Caryopsis* up to 2 mm. long, obovate flattened.

In the plains of the ASSAM VALLEY.

II. Brachiaria distachya Stapf, in Flor. Trop. Afr. IX. p. 565. Syn. *Panicum distachyum* Linn. Mant. I (1767) 138.

Culms 5-50 cm. long, often rooting at the base, angular and channelled, branched, robust or slender, glabrous, hairy at the nodes. *Leaf-blades* erect or spreading, linear-lanceo-acute or acuminate, rounded and almost amplexicaul at the base, thin, flat, 1·75-6 cm. long, 5-8 mm. wide, glabrous or with tubercle-based hairs, at least above; margins hispid, pale, glaucescent; sheaths carinate, striate, open, lax, glabrous or pubescent on the margins; ligule a thickened hairy ring.

Inflorescence a panicle, 2-5 cm. long, made up of 2-3 simple racemes, sub-conjugate, usually 2-3 cm. long. *Spikelets* elliptic-obovate, acute or sub-acute, short pedicelled, 2·5-3 mm. long; lower glume 1·5 mm. long, very wide up to 2·3 mm. embracing the spikelet completely, 5-7-nerved; upper glume corresponding in size and shape to the spikelet; upper glume 2-3 mm. long, membranous, ovate-acute, acuminate, 7-nerved. *Lower floret* neuter; lemma similar to the upper glume in texture and length, 5-nerved; palea narrow hyaline. *Upper floret* hermaphrodite, shortly stipitate, 2·5-2·8 mm. long; lemma subcoriaceous, elliptic or oblong, flattened or convex on the back, punctate-striate, faintly 3-nerved; palea flat, similar in texture to the lemma, margins much incurved.

Common in the plains.

21. STENOTAPHRUM Trin.

Spikelets lanceolate to ovate-oblong, falling entire (sometimes tardily) from the rudimentary pedicels, solitary or 2-3, rarely more-nate, abaxial on the triquetrous rhachis of very short spikelike racemes, more or less sunk in hollows or chambers on the anterior face of a dorsally flattened, herbaceous or spongy, continuous or jointed, common axis, or the longer racemes at least closely appressed to it; lower floret male or reduced to an empty lemma; upper floret hermaphrodite. *Glumes* dissimilar, the lower mostly minute, scale-like, the upper almost or quite equalling the spikelet

and 5-7-nerved, or similar and then both small, scale-like. *Lower floret*; lemma corresponding in size and shape to the spikelet, as seen from the front, chartaceous to coriaceous 3-7- (rarely more) -nerved, nerves sometimes very obscure; palea if present almost as long as the lemma, 2-keeled. *Upper floret*; lemma chartaceous to sub-coriaceous with firm margins, faintly 3-5-nerved; palea sub-equal to the lemma and similar in substance, tightly embraced by the narrowly involute margins of the former, faintly 2-nerved. *Lodicules* 2. *Stamens* 3. *Styles* free or almost so, very slender; stigmas, long, slender, laterally exserted. *Caryopsis* broadly elliptic-oblong, dorsally compressed, plano-convex.

Creeping or prostrate perennial or tufted, erect annuals; sheaths more or less, often strongly, compressed, blades acute or obtuse. *False spikes* terminal and often peduncled tough or at length breaking up at the joints.

Stenotaphrum dimidiatum Brongn. in Duperr. Bot. Voy. Coq. (1827) 127. Syn. *S. glabrum* Trin. Fund. Agrost. (1820) 176.

Perennial. *Culms* ascending from a creeping and prostrate base, up to 30 cm. high, internodes compressed glabrous, smooth. *Leaf-blades* folded in vernation, afterwards flat, exactly linear from a shortly contracted base, with sub-obtuse or rounded tips, 2·5-12·5 cm. long by 4-2·4 mm. wide, glabrous, scabrid on the margins close to the tip, otherwise smooth; sheaths compressed, keeled, all glabrous or ciliate upwards, very rarely loosely hairy all over; ligule a fringe of very short hairs.

False spikes solitary terminal on the primary and secondary culms, 4 cm.-12 cm. long, borne on a rather slender, glabrous peduncle; common axis glabrous, midrib wavy, stout, flat on the back and acutely keeled on the face, lateral angles herbaceously margined or winged, when seen from back, ribbon-like, alternately toothed or lobed, 2·5 mm. wide, distinctly chambered. *Racemes* sessile sunk in the chamber or shortly exserted, 3-5- (rarely 2- or 6-8-) spiculate; rachis wavy or zigzag ending in a subulate point; pedicels reduced to very short, sometimes ciliate, stumps. *Glumes* very dis-

similar; lower glume a whitish, membranous to chartaceous, ovate-obtuse or rounded scale, nerveless, 1-1.5 mm. long, asperulous and ciliolate at the tip; upper glume convex to boat-shaped, semi-ovate or semi-elliptic in profile, acute, usually shorter than the spikelet, membranous, typically 7- but sometimes 9- or 11-nerved; glabrous or ciliolate towards the tip. *Lower floret* male; lemma corresponding in outline and size to the spikelet, more or less coriaceous, 5-7-nerved, glabrous or ciliate near the tip; palea somewhat shorter than the lemma. *Upper floret* hermaphrodite, as long as the lower or only very slightly shorter, lemma and palea lanceolate, acute or acuminate, thinly chartaceous, smooth, glabrous or more or less ciliate upwards, the former 5-nerved, the latter 2-nerved with rounded sides. *Stigmas* rather large.

Recorded from MYMENSINGH and will certainly be found in SYLHET.

22. SETARIA Beauv.

Spikelets oblong to ovate in outline in dorsal view, very convex on the back, flattened or slightly depressed in front, base oblique in profile, falling entire from the pedicels, subtended by 1- to many persistent bristles (modified branchlets), gathered into contracted, spike-like or more or less open panicles; lower floret male or barren and sometimes reduced to the lemma; upper floret hermaphrodite. *Glumes* membranous, unequal; the lower usually much smaller, ovate from a clasping base, mostly 3-5- (rarely 1- or 7-) nerved; upper similar to the lower but longer and corresponding in size and outline to the spikelet, membranous, 5- (rarely 7-) nerved, flat or depressed longitudinally; palea if fully developed almost as long as the lemma, oblong to elliptic-oblong, acute, sharply keeled or the keels marginate or narrowly winged. *Upper floret*; lemma very convex on the back or boat-shaped, more or less apiculate, crustaceous, very finely pitted or more often transversely rugose; palea almost equal to the lemma, similar in substance, embraced all along by the involute margins of the latter up to its more or less prominent keels. *Lodicules* 2, broadly cuneate. *Stamens* 3; styles distinct; stigmas laterally exserted upwards. *Caryopsis* tightly enclosed by the hardened palea and lemma, ellipsoid in outline.

Annual or perennial herbs with narrow, flat leaves and terminal, contracted, cylindrical, or more or less open panicles. Spikelets usually sub-tended by bristles.

Key to the species of *Setaria*.

Leaf-blades folded fan-fashion between the primary nerves; inflorescence a loosely-spicate panicle; spikelets solitary, each subtended by a single bristle.

1. *S. palmifolia*.

Leaf-blades flat when expanded; inflorescence a false spike or narrow panicle; spikelets usually clustered and subtended by more than one bristle.

Bristles retrorsely barbed. 2. *S. verticillata*.

Bristles antrorsely barbed.

Upper glume as long as the upper lemma; the latter quite smooth:—

Spikelets persistent, lower floret epaleate. 3. *S. italica*.

Spikelets deciduous; lower floret paleate. 4. *S. viridis*.

Upper glume shorter than the upper lemma; the latter rugose:—

Inflorescence a narrow panicle, lobed, especially in the lower part, tapering upwards:—

Annual; spikelets up to 2 mm. long. 5. *S. intermedia*.

Perennial; spikelets 2·5-3 mm. long. 6. *S. forbesiana*.

Inflorescence a cylindric false-spike:—

Spikelets 3 mm. long. 7. *S. glauca*.

Spikelets up to 2·5 mm. long. 8. *S. pallide-fusca*.

The last two species are rather close together and the following gives their differences at greater length in order to aid identification.

Spikelets 3 mm. long; upper lemma coarsely rugose, boat-shaped and slightly keeled upwards, broad and dorsally strongly curved on the back in profile. *S. glauca*.

Spikelets 2·25 mm. long; upper lemma usually finely rugose, narrow and dorsally gently curved, not at all keeled. *S. pallide-fusca*.

1. *Setaria palmifolia* Stapf in Journ. Linn. Soc. XLII (1914) 186. Syn. *Panicum plicatum* Hook f. in F.B.I. VII (1897) 55.

A perennial grass. Culms 30 cm.-2·4 m. tall, erect or ascending from a branched, woody rootstock, stout, leafy;

nodes strigillose; internodes 5-15 cm. *Leaf-blades* 15-60 cm. long, 1·3-7·5 cm. wide, linear-lanceolate, finely acuminate, chartaceous, glabrous or sparsely hairy, plicate between the numerous veins, base narrow; sheaths smooth or hispid, the margins naked, or ciliate near the top only; ligule of long hairs.

Inflorescence a panicle 30-60 cm. long, contracted, nodding; rhachis stout, angular, scabrid; branches usually alternate, distant (the lower 7·5-10 cm. long) filiform, suberect, bearing short, capillary, few-flowered branches and bristle-like flowerless ones. *Spikelets* 3 mm. long, sessile or shortly pedicellate, ovoid, acute or apiculate, glabrous. *Lower glume* broadly ovate, obtuse, 5-nerved, membranous, half as long as the spikelet; upper glume a little more than half as long as the upper lemma, ovate, obtuse, 7-nerved, membranous. *Lower floret* barren; lemma slightly longer than the upper lemmata, ovate, shortly apiculate, membranous, empty; paleate or not, 5-nerved; the palea when present small, hyaline, narrowly ovate-acute; upper floret hermaphrodite; lemma crustaceous, ovate-oblong, acute or shortly apiculate, slightly transversely striate, pale yellow with strongly involute margins; palea ovate, acute, nearly as long as the lemma, faintly transversely striate and with incurved membranous margins.

Easily recognised by its lanceolate plicate leaves and open panicle. Spikelets soon deciduous. Essentially a forest grass and very common in plains and hills.

2. *Setaria verticillata* Beauv. Ess. Agros. (1812) 51.

Annual. *Culms* mostly loosely tufted, from a few cm. to 2 and even 3 m. high, more or less geniculately ascending, branched from the base or higher up, 4-9-noded, with nodes mostly exserted, lower, and often the intermediate, nodes usually compressed and the latter often deeply channelled on the side facing the branch, the uppermost (peduncle) not or not much longer than the preceding, slender, rough below the inflorescence. *Leaf-blades* linear or lanceolate-linear from a broad, slightly constricted and rounded, or from a narrow base, long tapering to an acute or sub-setaceous point, 5-30

cm. long; 1.5-1.5 mm. wide, thin, flat, often flaccid, green, usually loosely pilose with fine tubercle-based hairs, rough on the margins and frequently also on the nerves; leaf-sheaths thin, sub-herbaceous to herbaceous, the lower and intermediate usually compressed and keeled upwards, striate, finely and sparingly hairy upwards, or pubescent all over, rarely quite glabrous; ligule very short, truncate, ciliate.

Inflorescence an erect, straight or curved, or spirally twisted and curled, lobed, sub-cylindrical or continuous and cylindrical, false spike, 2.5-12.5 cm. long by 1.5-3 cm. wide (excluding the bristles), greenish, coarsely bristled; axis slender, angular, rough and often pubescent; branches spirally arranged, very close, terminating in a bristle; in robust specimens the lower up to 1.25 cm. long, bearing from the base mostly perfect spikelets in clusters of 2-3 or solitary, each cluster supported by few (4-2), or the solitary spikelet usually by 1 bristle, or all the branches short and reduced to sessile compound clusters; bristles rather coarse and downwardly angular, scabrid, retroseously barbed, 5 mm.-1 cm. long; pedicels small stumps, tips discoid. *Spikelets* oblong or obtuse in back view, 2.5 mm. long, 1.25 mm. wide, pale green. *Lower glume* hyaline, broadly ovate and 1.8-1 mm. long, 1- to sub-3-nerved; upper glume membranous, equal to the upper floret, 5-7-nerved. *Lower floret* barren; lemma similar to the upper glume 5- to sub-7-nerved, palea small, hyaline or absent. *Upper floret* hermaphrodite, broadly oblong, sub-apiculate or obtuse, pale green or at maturity straw-coloured; lemma thin sub-coriaceous, finely granular or more or less finely rugulose; palea of the same texture. *Anthers* 1 mm. long. *Caryopsis* broadly elliptic in outline, white-translucent, over 1.8 mm.

Rather uncommon. NAGA & KHASI HILLS and plains.

3. *Setaria italica* Beauv. Ess. Agrost. (1812) 51.

An annual. *Culms* fascicled, erect or from a geniculate base, more or less stout, glabrous, scabrid below the panicle. *Leaf-blades* linear from a contracted base, tapering to a setaceous point, 15-45 cm. long, 7.5-10 mm. wide, flat, soft, green, glabrous, scabrid on the upper surface; margins finely

cartilaginous; sheaths more or less tight, glabrous, except for the finely ciliate margins, sometimes the lower sparingly hairy on back and sides; ligule a densely ciliate rim.

Inflorescence an erect or nodding, continuous and cylindric, or more or less lobed false spike, green or when mature, yellowish; rhachis rather stout, angled, more or less rough on the angles; branches spirally arranged or more or less whorled, tomentose at the base; branches and branchlets bearing sessile or sub-sessile involucres, each supporting a group of 2-4 spikelets; bristles 2-3, rarely more, to each cluster; pedicels short; tips discoid. *Spikelets* persistent, broadly oblong to broadly elliptic, obtuse in back view, 2.5-3.25 mm. long. *Lower glume* broadly ovate-acute or sub-acute, .8-1 mm. long 1-3-nerved; upper elliptic, concave, sub-acute or obtuse, 1.6-2 mm. long or more, 5-7-nerved. *Lower floret* barren; lemma similar to the upper glume, dorsally flattened or depressed, 5-nerved; palea a hyaline scale or absent; upper floret hermaphrodite; lemma as long as the spikelet and corresponding to it in shape, reddish or yellow at maturity, crustaceous, smooth or almost so; palea of the same texture. *Caryopsis* ellipsoid or globose-ellipsoid, 1.8-2.5 mm. long.

Cultivated throughout the hills up to 6,000 ft.

4. *Setaria viridis* Beauv. Ess. Agrost. (1812) 51, 178, t. xiii, fig. 3.

An annual grass. *Culms* loosely tufted, slender, weak, erect, or more often ascending from a geniculate base, branched from the base, upper node long exserted, very slender, smooth and glabrous, scaberulous below the inflorescence. *Leaf-blades* linear-lanceolate from a slightly constricted base, long tapering to a very slender point, 3-20 cm. long, 5-10 mm. wide, flat, soft, glabrous, scaberulous on the upper surface; margins scaberulous, cartilaginous; midrib slender; sheaths thin, terete, slightly keeled upwards, glabrous or ciliate upwards and scantily hairy with tubercle-based hairs; ligule reduced to a ciliate rim.

Inflorescence an erect, oblong or linear-cylindric, dense, continuous, false spike, 2-5 cm. long, greenish; rhachis terete,

angular, or sulcate, minutely and rigidly puberulous, often with some longer silky hairs; branches reduced to sessile or sub-sessile involucres each supporting a cluster of 2-6 spikelets, half being imperfect; bristles up to 14 in each cluster, somewhat unequal, straight or more or less flexuous, scabrid, up to 10 mm. long; pedicels reduced to short stumps with minute discoid tips. *Spikelets* oblong, obtuse in back view, semi-elliptic in profile, 2-2.5 mm. long, pale greenish. *Glumes* thinly membranous, very unequal, lower rotundate or rotundate-ovate, obtuse, one-fourth to one-third the length of the spikelet, 1-nerved; upper shape and size of the spikelet, 5-7-nerved. *Lower floret* barren; lemma similar to the upper glume but more or less depressed or flattened; palea a hyaline scale about .5 mm. long. *Upper floret* hermaphrodite; lemma oblong, sub-acute or obtuse, pale, thinly crustaceous, smooth or very delicately punctate. *Stamens* 3, anthers .5 mm. long. *Grain* broadly elliptic, very obtuse, plano-convex, 1.5 mm. long, greyish: hilum punctiform.

Found occasionally in Shillong, KHASI HILLS. Probably introduced.

5. *Setaria intermedia* Roem. et Schult. Syst. II (1817) 489.

An annual. *Culms* tufted, geniculate, linear, rarely erect, up to 1 m. high, glabrous, smooth or minutely scabrid below inflorescence. *Leaf-blades* linear from a narrow and slightly rounded base, tapering to a fine setaceous point, flat, flaccid, green, hairy, very rarely glabrous, rough on the margins; leaf-sheaths thin, ciliate along the margins, often bearded at the mouth, somewhat keeled and compressed; ligule reduced to a long-ciliate rim.

Inflorescence a straight or flexuous, more or less loose, interrupted or lobed, false spike, 2.5-10 cm. long, greenish; branches very variable, the lower intermediate up to 1.5 cm. long, the upper reduced to sub-sessile clusters or solitary spikelets supported by a bristle; clusters of usually 2 spikelets, one of which is perfect with few bristles; bristle antrorse-ly scabrid, usually 3.5 mm. long; pedicels minute stumps

with discoid tips. *Spikelets* broadly ovate to elliptic and sub-apiculate, rather oblique and sub-gibbous, up to 2.5 mm. long, pale-green or straw-coloured. *Lower glume* broadly or rotundate-ovate, acute to sub-acute, half as long as the spikelet, 3-5-nerved; upper similar but more elliptic, very concave and up to 2/3 length of the upper floret, 5-7-nerved. *Lower floret* barren; lemma membranous, elliptic-oblong, sub-acute, dorsally depressed, 5-nerved; palea elliptic, slightly shorter than lemma, acute, keels marginate. *Upper floret* hermaphrodite; lemma boat-shaped, apiculate, not quite 1.25 mm. wide, rich yellow, when mature more crustaceous, sharply transversely rugose; palea similar in texture but only slightly rugose. *Caryopsis* rotundate-ovate in outline, obtuse, 1.5 mm. long, plano-convex, whitish; hilum punctiform; scutellum ovate, $\frac{3}{4}$ the length of the grain.

Rather uncommon. Found in the plains and also in the hills up to 3,000 ft.

6. *Setaria forbesiana* Hook. f. F. B. I. VII (1897) 81.

A perennial. *Culms* erect, stout, up to 2 m. tall, from a stout rhizome, occasionally lower nodes somewhat geniculate and emitting short roots, smooth or glabrous, except for a minute scabridity below the inflorescence, striate, leafy to the just below the inflorescence or with a long peduncle emerging from the uppermost leaf-sheath, simple or branched below; nodes dark in colour. *Leaf-blades* linear-lanceolate from a rounded base, flat, tapering to a fine point, 4-45 cm. long, 4 mm.-1.6 cm. wide, both surfaces covered with sparse hairs to almost glabrous, both surfaces very scabrid; margins not thickened, scabrid, median nerve very prominent below; sheaths rather loose and scarious below, keeled and rather tighter above, smooth and glabrous or covered with sparse hairs and rough; margins ciliate, often covered with tightly appressed hairs towards the top, collar dark coloured; ligule of long silky hairs.

Inflorescence a panicle, strict; rachis stout, either narrowly pyramidal with erecto-patent lower branches 6-6 cm. long, or spiciform with short branches, rather open,

branches often 1 cm. or more apart and ending in a bristle; rhachis and branches angled, channelled and scabrid; spikelets seated on very short peduncles, ovoid, green, solitary or often near the rhachis joined by an imperfect floret; involucre of 1-few, or 0, bristles, 2·5-3·2 mm. long. *Lower glume* 1·5-3 mm., broadly ovate, acute or obtuse, clasping the base of the spikelet; upper glume 2·25 mm. long, 7-nerved, broadly ovate or orbicular, acute or obtuse, 7-9-nerved. *Lower floret* barren or male; lemma broadly ovate, obtuse, 7-nerved, 2·75 mm. long; palea elliptic, apex obtuse. *Upper floret* hermaphrodite; lemma ovate-acute, crustaceous, yellow or white, transversely rugose, margins sharply incurred; palea of the same texture and shape, 2·5 mm. long.

KHASI & JAITIA HILLS, 2,4000 ft.

7. *Setaria glauca* Beauv. Ess. Agrost. (1812) 51.

Annual. *Culms* loosely tufted, geniculate, rarely erect from base, 30-60 cm. tall, or stunted, slender, or stout downwards, smooth or slightly rough below the inflorescence. *Leaf-blades* linear from a slightly contracted base, tapering to a slender point, 5-30 cm. long, up to 1 cm. wide, flat, flaccid, glabrous or with a few white hairs towards the base, slightly rough on the margins; leaf-sheaths thin, the lower compressed and finely keeled, upper terete, glabrous and smooth; ligule reduced to a ciliate rim.

Inflorescence an erect, dense, continuous, linear, cylindric, false spike up to 10 cm. long and 1 cm. wide, fulvous to rufous; rhachis slender, terete, minutely pubescent; branches reduced to a sessile involucre each supporting a solitary perfect spikelet frequently with a more or less arrested companion. *Bristles* 6-8 to each involucre, slender, rigid, scabrous, very unequal up to 1 cm. long, pale at base, fulvous upwards; pedicels reduced to small stumps with a discoid tip. *Spikelets* broadly oblong to elliptic in back view, 3·75 mm. long, pale green in flower, rather turgid when mature. *Lower glume* membranous, tightly appressed, rotundate-ovate, subacute to obtuse 1/3 to 2/3 the length of the spikelet, 3-nerved; of the same shape and texture, 5-nerved. *Lower floret* male, or in weak specimens barren, as long as the upper floret,

lemma membranous, 5-nerved, very flat, or somewhat depressed on the back; palea as long as the lemma or shorter, broadly elliptic, acute, keels marginate; perfect anthers up to 1.8 mm. *Upper floret* broadly boat-shaped, very convex on the back; lemma crustaceous, distinctly transversely rugose, yellow or almost orange; palea granular-punctate, with stout keels; anthers 1 mm. long. *Caryopsis* roundate-elliptic in back view; plano-convex; hilum punctate; scutellum ovate, more than half the length of the grain.

The grain can be eaten in times of famine. Fairly common in the hills and plains.

8. Setaria pallide-fusca Stapf et C. E. Hubbard,
Kew Bull. (1930) 259.

Annual. *Culms* tufted, usually 30-60 cm. high, sometimes more, often tufted, slender, smooth, except slightly scaberulous below the inflorescence, usually ascending from a geniculate base, glabrous. *Leaf-blades* linear, long tapering to a fine point, not or only slightly contracted at the base, 5-25 cm. long, 2.5-7.5 mm. wide, flat or often infolded, glabrous or with a few hairs towards the base, slightly rough on upper surface inside the margins; leaf-sheaths thin lower compressed and keeled, upper terete, smooth and glabrous; ligule, hyaline, truncate, lacerate-ciliate.

Inflorescence an erect, dense, continuous false spike, 1.5-7.3 cm. long, mostly rufous, rarely fulvous or purplish; rachis slender, terete, sub-angular, minutely pubescent; branches reduced to sessile or sub-sessile, involucres each supporting a solitary perfect spikelet, frequently with an arrested companion; bristles about 8 to each involucre, fine to very fine, rigid or somewhat flexuous, scaberulous, 7.5 mm.-1 cm. long; pedicels reduced to small stumps with discoid tips. *Lower glume* 1/3-2/3 the length of the spikelet, 3-nerved, membranous, tightly appressed, rotundate to rotundate-obtuse, subacute or obtuse; the upper same texture and shape up to half the length of the spikelet, 5-nerved. *Lower floret* male or barren; lemma membranous, 5-nerved, depressed along the middle; palea as long as or slightly shorter than the lemma, elliptic-oblong to oblong, with marginate

keels, anthers if present up to 2·5 mm. long. *Upper floret* hermaphrodite, boat-shaped with a broadly rounded back; lemma thinly crustaceous, transversely rugose, yellowish-green with often brown tips; palea granular-punctate, anthers .9 mm. to 1·2 mm. long. *Caryopsis* elliptic-rotundate from the back, plano-convex, 1·6 mm. long, scutellum more than half the length of the grain.

An excellent fodder for all stock. The grain is edible. Very common all over the province in plains and hills.

23. PSEUDORAPHIS Griff.

Spikelets 2-flowered, narrow lanceolate, rounded, shortly pedicelled, obscurely articulated on their pedicels but persistent. *Lower glume* very small, suborbiculate, hyaline, without nerves; upper glume longer, sometimes equalling the spikelet in length, very long acuminate, subulate or aristate, 5-many-nerved. *Lower floret* male or neuter; lemma often shorter than the spikelet, lanceolate, acute, acuminate or aristate, 7-nerved, palea shorter than the lemma, hyaline, obscurely nerved. *Stamens* 3. *Anthers* short. *Upper floret* hermaphrodite or female, stipitate, very small; lemma oblong acute, flat, broadly coriaceous, feebly nerved; palea scarcely coriaceous, acute, margins involute but not auricled, not nerved; lodicules wedge-shaped. *Caryopsis* linear-oblong, compressed, free between the coriaceous lemma and the hyaline palea.

Glabrous, or nearly so, herbs, aquatic or living in swamps. *Leaf-blades* linear or lanceolate, flat. The inflorescence is a terminal, peduncled, simple, panicle, with each long, filiform branch produced beyond the terminal spikelet into a scabrous bristle.

Key to the species of *Pseudoraphis*.

Spikelets 8-10 mm. long.	..	..	1. <i>P. brunonianana</i> .
Spikelets 3-5-4 mm. long	..	..	2. <i>P. minuta</i> .

1. ***Pseudoraphis brunonianana* Griff.** Notul. ad Plant. Asiat. III (1851) 29. Syn. *Chamaeraphis spinescens*

Poir. Encycl. Suppl. II (1811) 189, var. *brunonianana* Hook. f. F. B. I. VII (1897) 62.

A floating grass forming extensive patches. *Culms* 30-90 cm. long, ascending, extended, very branched, striate, nodes numerous, the lower kneeled. *Leaf-blades* flat, narrowly linear-lanceolate, narrow at the base, smooth or scabrid, 2·5-7·5 cm. long; sheaths long, lax, pubescent on the throat, margins devoid of cilia; ligules hairy.

Inflorescence a pyramidal panicle, contracted then spreading, 5-10 cm. long; axis and branches angular, furrowed, almost smooth and scabrid-hispid, flexuous or nearly so, lower branches 2·5-3 cm. long, terminated by a bristle often 1·5-2 cm. long; pedicels short, thick, obconic. *Spikelets* 1 to 2, rarely 3 on the branches of the panicle, lanceolate, 8-10 mm. long, long awned; lower glume 8-1 mm. thin, whitish, orbicular, truncate or reniform, clasping; upper glume 8-10 mm. long, awned, or long-acuminate; oblong, scabrid on the convex back, smooth or with silky hairs on the sides; awn scabrid, sometimes as long as the spikelet. *Lower floret* male or neuter; lemma 7-8 mm., finely acuminate, awned, many nerved, margins thin, clasping the palea; palea 4-5 mm. hyaline, margin infolded. *Upper floret* hermaphrodite; lemma 2·5-3 mm. long, coriaceous-papyraceous, narrow, linear-oblong, acute, embracing the palea; palea a little shorter and as broad, thin, oblong. *Caryopsis* ovate-oblong, less than 1·5 mm.

SYLHET & MYMENSINGH.

2. **Pseudoraphis minuta** (Mez) Pilger in Notiz. Bot. Gart. Berlin, X, (1927-30) 210. Syn. *Chamaeraphis gracilis* Hack. apud Hook. f. F. B. I. VII (1897) 62 non Hack. in Engl. Jahrb. VI (1885) 236.

Perennial. *Culms* 20-35 cm. long, very slender, compressed, often simple, glabrous, 3-6-noded, the lower nodes hairy. *Leaf-blades* soft, flat, green, spreading, linear-acuminate, base slightly contracted, 2·5-4 cm. long by 3-4 mm. wide, often glabrous; sheaths broad, lax, keeled, compressed, much shorter than the internodes, glabrous, save at the throat and at the base; ligules very short, hyaline, toothed.

Inflorescence an oblong panicle, very lax, contracted, slender, soft, shortly exserted from the sheath of the uppermost leaf, 4·5-5 cm. long: rhachis filiform, angular, scabrous towards the summit; branches often 2-nate, erect, spreading, unequal, usually simple, almost capillary, angular, very scabrid, sub-flexuous, carrying 5-10 spikelets; awn terminal, scabrid, 3-5 mm. long. *Spikelets* distant, alternate, lanceolate, flat on one side, very convex on the other, glabrous. 3·5-4 mm. long, green or slightly-brown; pedicels very short; lower glume extremely short, membranous, rounded truncate, 3-nerved; upper glume 3·5-4 mm. long, ovate, finely acuminate, cuspidate, with 7-9 strong, green, scabrid, glabrous or hairy nerves. *Lower floret* male or neuter; lemma 2·2-5 mm. long, membranous, ovate-sub-acute, 7-9-nerved; palea a little shorter, hyaline, oblong, sub-elliptic, 2-nerved. *Upper floret* hermaphrodite; lemma 1·2 mm. long, oblong-acute, sub-chartaceous, translucent; palea ovate-oblong, acute, of the same texture as the lemma. *Caryopsis* elliptic-lanceolate, whitish, grooved on one face.

Bils in the Surma VALLEY.

24. PENNISETUM L. Rich.

Spikelets lanceolate to ovate, or ovate-oblong to elliptic-oblong, acute or obtuse, sessile or short pedicelled, solitary or in fascicles of 2-5, surrounded by and deciduous* with the sessile or peduncled involucres formed of few to many naked or hairy bristles, arranged round the slender to stout rhachis of spikelike often cylindrical panicles; lower floret male or barren with or without a palea; upper floret hermaphrodite. *Glume* sub-equal or lower usually smaller. *Lower floret*: lemma as long as or shorter than the spikelet, palea narrow, 2-keeled. *Upper floret*: lemma as long as the spikelet or shorter, 5-7-nerved, palea similar to that of the lower floret. *Lodicules* minute or absent; stamens 3, anthers linear or oblong, with naked or penicillate tips. *Styles* slender, connate or free, stigmas usually free, terminally or laterally exserted.

Cæspitose or stoloniferous perennials or annuals; culms simple or often profusely branched. *Leaf-blades* linear to

lanceolate, flat, folded or convolute; ligule reduced to a ciliate rim. *False spikes* solitary (or fascicled) usually dense, linear or linear-lanceolate, rarely oblong; branches very numerous, short, leaving scars as they fall away: bristles very slender or capillary.

* Persistent in cultivated forms.

Key to the species of *Pennisetum*.

Lemmas more or less alike:—

Spikelets usually solitary in each involucre; bristles sparingly ciliate.	1. <i>P. alopecuroides</i> .
Spikelets 1-4 in each involucre; bristles, at least the inner, plumose:—	
Anther tips glabrous; inflorescence en- closed in the upper leaf-sheath.	2. <i>P. clandestinum</i> .
Anther tips bearded; inflorescence ex- serted:—	
Panicle stout; cultivated for its grain; annual.	3. <i>P. typhoides</i> .
Panicle slender; cultivated for fodder; perennial.	4. <i>P. purpureum</i> .
Lemmas heteromorphous.	5. <i>P. polystachyon</i> .

1. ***Pennisetum alopecuroides* Spreng. Syst. I.
(1825) 303. Syn. *P. compressum* R. Br. Prod. (1810)
195.**

Perennial. Rhizome knotty, woody, with many strong roots. Culms 30-60 cm. high, erect, simple, densely tufted, closed, rounded, glabrous save below the inflorescence a number of white hairs. Leaf-blades erect, rolled, linear, long acuminate, compressed, striate, glabrous save at the base, 30-45 cm. long by 4-6 mm. wide, margins slightly scabrid; sheaths open to near the base, lax compressed, keeled, striate, glabrous, pubescent on the margins; ligules very short, fimbriate in upper leaves, membranous in lower.

The panicle is linear-oblong in shape, green or purple, 5-60 cm. long; rhachis angular, furrowed, hairy; pedicels erect, hairy, thick at the summit, 1.5-2 mm. long; involucre pedicelled, of 12-15 bristles, which are pale or purplish-black, flexuous, erect, spreading, scaberulous, all free at the base, unequal, attaining 2.5 cm. in length. Spikelets linear-

oblong, acute, erect or spreading, 1-2-nate, 7-8 mm. long. *Lower glume* very short, membranous, ovate or sub-orbicular; upper glume membranous, 3-5-4 mm. long, ovate-lanceolate, acute, 3-5-nerved. *Lower floret* neuter; lemma 6.5-7.5 mm. long, closely enveloping the upper floret; palea absent. *Upper floret* hermaphrodite; lemma 7-8 mm. long, papyraceous, membranous on the margins, ovate-lanceolate, acute, obscurely 5-7-nerved, clasping the palea; palea 6.5-7.5 mm., membranous on the margins. *Caryopsis* blackish-brown, ovate, crowned with the styles.

NAGA HILLS, 4,500 ft. The grain can be eaten in times of want.

2. *Pennisetum clandestinum* Hochst. ex Chiov. in Ann. Istit. Bot. Rom. VIII (1903) 41.

A perennial grass with numerous creeping rhizomes and slender or stout stolons rooting at the nodes. *Culms* very short usually appressed to or hardly raised above the ground, copiously branched. *Leaf-blades* linear, tapering to an obtuse tip, up to 12 cm. long, 3-6 mm. wide when flattened, tightly folded at first afterwards opening, spreading, rather succulent, more or less glaucous, glabrous or sparingly and shortly hairy, smooth except on the margins and midrib near the tip; leaf-sheath closely imbricate, short, almost membranous, pale, glabrous or shortly hairy; ligule a densely ciliate rim.

Inflorescence reduced to a cluster of 2-4 (mostly 3 or rarely 1) spikelets, sub-sessile and enclosed for the greater part in the uppermost leaf-sheath, the terminal spikelet shortly pedicelled the other sessile; bristles delicate, finely scaberulous or ciliolate, those of the involucre of the terminal spikelet up to 15, very unequal in length, the longest $\frac{1}{4}$ the length of the spikelet, of the lateral spikelets fewer and only on the outer side of the spikelet. *Spikelets* linear-lanceolate, 15-20 mm. long, glabrous, whitish below, greenish upwards. *Lower glume* a very minute, hyaline, nerveless scale often suppressed; upper ovate to ovate-rotundate, up to 2.5 mm. long, or rarely linear-lanceolate and up to 10 mm. long, hyaline nerveless or obscurely few-nerved. *Lower floret*

barren and reduced to the lemma; lemma lanceolate, long tapering, sub-acute, as long as the spikelet, thinly membranous, 8-12-nerved; palea absent. *Upper floret* hermaphrodite and markedly protogynous or functionally female with rudimentary stamens; lemma very similar to that of the lower floret but slightly shorter; palea linear-lanceolate, long-acuminate, very thin, 2-4-nerved. *Lodicules* 0. *Stamens* in the hermaphrodite floret with very long protruding filaments up to 5 cm. long and dangling anthers 5-7.5 mm. long, in the female floret much reduced with empty anthers which remain permanently enclosed. *Style* long exserted up to 40 mm. long, simple or shortly bifid, finely plumose from below the middle upwards. *Grain* oblong ellipsoid 2.5-3 mm. long, brown.

This grass has been introduced into ASSAM from AFRICA as a fodder grass. It is known as "Kikuyu grass."

3. *Pennisetum typhoides* Stapf & Hubbard in Kew Bull. 1933, 271. Syn. *Alopecurus typhoides* Burm. Fl. Ind. (1768) 27; *Pennisetum typhoideum* L. Rich in Pers. Syn. I (1805) 72 (in part).

Annual. *Culm* erect up to 3 m. tall, slender or stout, simple or branched, nodes hairy above, culm tomentose below the inflorescence, otherwise glabrous, smooth. *Leaf-blades* linear to linear-lanceolate, acute, 15-60 cm. long, 9 mm.-4 cm. wide, flat, glabrous or loosely hirsute, smooth or scaberrulous; sheaths ciliate on the margins and in case of upper leaves densely bearded at junction with blades, glabrous and smooth, or hirsute and rough; ligule a dense fringe of hairs.

False spike cylindric or tapering towards base and apex, 6-32 cm. long, not or slightly bristly, pale and brown or purple, rhachis slender to stout villous, closely beset with the stalked persistent involucres. *Stalks* 1-8 mm. long, densely pilose; bristles up to 70 to each involucre, very slender, inner stout, plumose round spikelet with silky hairs, 4-7 mm. long, sub-equal. *Spikelets* in clusters of 2-5 or solitary, pedicelled (with the pedicel 5-1.5 mm. long), oblong or elliptic-oblong 2.5-5 mm. long. *Glumes* broad, truncate or very obtuse, hyaline and thinly membranous, ciliolate at the

apex; lower 5-1.5 mm. long, nerveless; upper 7-2.5 mm. long, nerveless or 3-nerved. *Lower floret* male or barren: lemma when flattened elliptic-oblong to broadly oblong, truncate or emarginate, sometimes mucronulate, 1/3 the length to almost as long as the spikelet, 1-5-nerved, glabrous or ciliolate at the apex; palea as long as the lemma, narrowly oblong truncate, scaberulous on the keels, or suppressed. *Upper floret* hermaphrodite, frequently disarticulating from the rest of the spikelet at maturity; lemma ovate to broadly ovate-elliptic, obtuse, as long as the spikelet, coriaceous, 5-7-nerved, minutely pubescent on the margins, smooth and shining on the back below the strongly nerved tip; palea lanceolate, truncate, as long as the lemma, glabrous and smooth on the back, pubescent on the flaps. *Anthers* 3 mm. long. *Caryopsis* obovoid or obovoid-ellipsoid 2.5-3 mm. long, tip pale grey or greyish white.

Cultivated in UPPER ASSAM and occasionally met with as an escape.

4. *Pennisetum purpureum* Schum. et Thonn. Beskr. Guin. Pl. 64.

A perennial grass from a creeping rhizome. *Culms* erect, tufted, 2-3 m. tall, branched; branches erect, terete, glabrous, smooth; nodes exserted from the sheaths, glabrous or more often with a ring of stiff, long, appressed hairs. *Leaf-blades* linear, tapering to a setaceous point, 30-75 cm. long by 2.5 cm. wide, dull green, glaucous or tinged with purple, more or less rough on both sides, glaucous beneath, usually more or less hairy above, especially towards the base; hairs tubercle-based; margins spinulose scabrid; sheaths terete, clasping the stem, striate, glabrous and smooth, or pubescent to hirsute with tubercle-based hairs near the tip; ligule a narrow rim bearing a dense fringe of white hairs 2-3 mm. long.

Inflorescence a dense, cylindric, erect false spike, 8-30 cm. long and 1.5-3 cm. in diameter, yellow or tinged with brown, purple or blackish-purple, made up of deciduous spikelets or fascicles of spikelets, each spikelet or fascicle surrounded by an involucre of numerous bristles of

unequal length, mostly 4-8 mm. long, one usually very much longer, scabrid, one or several of the innermost and longest sparingly plumose towards the base, rarely all naked. *Spikelets* sessile or if in fascicles of 2-4 the lateral pedicelled, all lanceolate, more or less acuminate, 5-7 mm. long, glabrous, straw-coloured or tinged with brown or purple, hermaphrodite, or if fascicled the lateral male, rarely neuter or all hermaphrodite. *Lower glume* suppressed or rudimentary, upper ovate to ovate-lanceolate, 5-1 mm., rarely 2 mm. long, sub-hyaline, 1-nerved or nerveless. *Lower lemma* male or more often barren, lanceolate, acute or acuminate, half as long as the upper glume, 3-nerved, rarely 1-7-nerved; palea linear-lanceolate, 2-nerved, shorter than the lemma or quite suppressed. *Upper floret* hermaphrodite; or male in lateral spikelets, lemma lanceolate-acuminate, scaberulous upwards, usually 5-nerved; palea narrow, linear-lanceolate, tips minutely 2-toothed. *Lodicules* 0. Anthers 2.5-3 mm. long, tip minutely penicillate. Styles united, stigma slender 4 mm. long.

A very valuable fodder grass introduced into ASSAM from AFRICA.

5. Pennisetum polystachyon Schult. Mant. II (1824) 147. Syn. *P. borbonicum* Kunth, Rev. Gram. I (1815) 259.

A perennial or rarely an annual. *Culms* erect or geniculately ascending, sometimes rooting at the lower nodes, 2 m. or more high, slender to stout, terete, branched or rarely simple, usually glabrous, scaberulous towards the inflorescence, otherwise smooth. *Leaf-blades* linear to lanceolate, rounded or narrowed at the base, acute, up to 45 cm. long, 3-15 mm. wide, flat, flaccid or firm, scaberulous or smooth below, densely hirsute behind the ligule; margins at base ciliate, otherwise glabrous, or loosely to densely pilose with spreading tubercle-based hairs.

False spike cylindric, very dense to somewhat lax, straight or flexuous, erect or nodding, 2.5-25 cm. long, purple, reddish-brown or orange-brown; branches slender, angled, glabrous, scaberulous, scarred; involucres sub-sessile;

bristles up to 30 for each involucre, slender, densely ciliate around spikelet, scaberulous above, one bristle stouter than the rest and up to 3 cm. long, the remainder varying up to 9 mm. *Spikelets* solitary, sessile, oblong-acute, 4-5 mm. long, glabrous. *Lower glume* linear or lanceolate, acute or obtuse, 5-1 mm. long, hyaline, nerveless, or suppressed; upper, when flattened, oblong or elliptic-oblong, acute, acuminate or mucronate, or 3-lobed, thin membranous, 5-(rarely 7-) nerved, papillose above the middle. *Lower floret* male or barren; lemma 3-4 mm. long, 3-lobed with the lobes equal and obtuse or with the middle lobe erect and shorter or longer, otherwise similar to the upper glume; palea linear, obtuse, up to 3.5 mm. long, keels scaberulous or smooth, or palea absent. *Upper floret* hermaphrodite, lanceolate-obtuse, lemma when flattened ovate-oblong, truncate, 2-3 mm. long, chartaceous, shining, obscurely 5-nerved, ciliolate at the apex; palea rather similar to the lemma. *Lodicules* 0. *Anthers* 1.75-2 mm. long with glabrous tips. *Styles* free or connate at the base. *Caryopsis* oblong or elliptic-oblong, 1.2 mm. long.

This species is represented from ASSAM by one sheet in the Kew Herbarium. It has not been collected since and is very doubtfully a native of India.

25. RHYNCHELYTRUM Nees.

Spikelets laterally compressed and keeled, falling entire from the capillary pedicels of a compound or decompound panicle. *Florets* 2; the lower usually male, the upper hermaphrodite. *Glumes* dissimilar, usually more or less distant, the lower ranging from an annular ciliate rim to an ovate-oblong scale, one-third the length of the spikelet, 1-nerved or nerveless; upper as long as the spikelet, frequently dorsally gibbous below the middle, emarginate, rarely entire, muticous, mucronate or awned from the sinus 5-rarely 7-nerved, villous to pubescent, rarely glabrous below. *Lower floret*; lemma similar to the upper glume or dissimilar, palea as long as the lemma, 2-keeled; keels ciliate or scaberulous. *Upper floret*; lemma smaller than the lower, ovate to elliptic-oblong, truncate, emarginate, membranous to thinly

chartaceous, 3-5-nerved, glabrous and very smooth; palea as long, 2-nerved. *Lodicules* 2, very small. *Stamens* 3. *Caryopsis* oblong-ellipsoid.

Annual or perennial grasses with linear or filiform leaf-blades. *Panicle* open or contracted. *Spikelets* often clothed with brightly coloured hairs.

Rhynchelytrum repens (*Willd.*) C. E. Hubbard in Kew Bull. (1934) 110. Syn. *Tricholaena rosea* Nees, Cat. Sem. Hort. Vratisl. (1835), (in part).

A tufted annual or perennial grass. *Culms* erect from a geniculate base, often rooting from the lower nodes, up to 1 m. tall, terete, simple or branched, glabrous and smooth or pubescent. *Leaf-blades* narrowly linear to linear, long and finely acute, 5-30 cm. long, 2·5-12·5 mm. wide, flat or folded, green or glaucous, glabrous to pubescent; sheaths finely striate or smooth, glabrous or hairy, tight or loose; ligule a minutely ciliate, membranous rim, 2·5 mm. long.

Inflorescence an oblong, ovate or pyramidal panicle, 5-20 cm. long, effuse or contracted, silvery-white, purplish or cream, silky-hairy; rachis slender, terete or channelled on one side, glabrous or pubescent at the nodes; branches paired or solitary; branchlets capillary; pedicels with discoid tips. *Spikelets* ovate to broadly oblong, 3·1-7·5 mm. long, pale, greyish-brown or dark-brown, silkily pilose to villous, with, at first appressed eventually spreading silky, white or purplish hairs, smooth or densely tuberculate. *Lower glume* linear to oblong, obtuse, truncate or emarginate, 1-2 mm. long, membranous, 1-nerved, densely bearded at the base, pilose; upper glume ·6 mm. above the lower, as long as the spikelet, semi-ovate in profile, tapering into a beak, shortly and obtusely 2-lobed, mucronate or with an awn up to 5 mm. long, chartaceous, 5-nerved, densely villous, hairs exceeding its length; margins ciliate. *Lower floret* male or barren; lemma similar to the upper glume; palea lanceolate 3·4-4 mm. long, membranous, keels ciliate. *Upper floret* hermaphrodite; lemma elliptic-oblong when flattened, emarginate 2·5-3 mm. long, thinly chartaceous, 5-nerved, glab-

rous; palea as long or almost as long, 2-nerved. Grain 1 mm. long.

Considered to be a weed in SOUTH AFRICA, in INDIA it has some repute as a fodder grass and has been introduced into ASSAM. It is known as "Natal grass."

18. ANDROPOGONEÆ.

Annual or perennial herbs, frequently with tall culms; leaf-blades linear to lanceolate or ovate; spikelets usually in pairs (rarely in threes or solitary), one of each pair (or three) sessile, the other (or both) pedicelled, those of each pair (or three) similar or more often dissimilar, 2-flowered with the lower floret male or barren and the upper hermaphrodite or female, or male or barren in the pedicelled spikelets, or the latter suppressed and with only the pedicel present, falling entire at maturity with the joints of the usually articulate rhachis of solitary, digitate or panicled spike-like racemes; rhachilla not produced beyond the upper floret; glumes more or less rigid and firmer than the lemmas, the lower always longer than the florets; lemmas membranous or hyaline, the upper usually with a geniculate awn from the entire or the sinus of the 2-lobed tip; paleas shorter than the lemmas, frequently the lower or both suppressed; lodicules usually 2; stamens 3, rarely 1 or 2.

Key to the genera of *Andropogoneæ*.

Internodes of the rhachis and pedicels slender, filiform; rarely thickened upwards; or if thickened upwards spikelets 1-flowered and awned :—

Spikelets all alike (or very similar) in shape and sex, or the pedicelled spikelets suppressed; spikelets 1-2-flowered: (*lower floret absent in M. monanthum, glume dorsally deeply channelled*) :—

Spikelets arranged in more or less compound panicles of spike-like racemes; spikelets awnless or awned, often surrounded by silky hairs :—

Spikelets all pedicelled; rhachis of racemes continuous and tough :—

Racemes peduncled; spikelets awned. **1. Eccoilopus.**

Racemes sessile :—

Spikelets awnless; racemes in a spiciform or contracted silvery panicle.

2. Imperata.

- Spikelets awned; racemes on an elongated axis, rarely sub-digitate. **3. Miscanthus.**
- Spikelets paired, one sessile the other pedicelled, or if both pedicelled, then glumes coriaceous :—
- Spikelets all pedicelled; rhachis of racemes tough, spikelets awned. .. **4. Sclerostachya.**
- Spikelets with one sessile and the other pedicelled; rhachis of racemes fragile :—
- Spikelets usually awnless :—
- Glumes coriaceous or chartaceous throughout; panicles narrow, villous to tomentose. **5. Narenga.**
 - Glumes membranous, or only chartaceous at the base; panicles wide, silky-hairy. **6. Saccharum.**
 - Spikelets awned; glumes thin; panicles silky-hairy. **7. Erianthus.**
- Spikelets arranged in digitate or scattered or solitary racemes :—
- Spikelets paired, one sessile and the other pedicelled or both pedicelled :—
- Racemes digitate, paired or scattered :—
- Leaf-blades mostly lanceolate to linear-lanceolate, often contracted at the base, lower glume rarely villous; lower glume with a narrow median groove; culms mostly decumbent. .. **8. Microstegium.**
 - Leaf-blades usually linear, usually gradually passing into the sheaths; lower glume more or less villous; lower glume without a median groove :—
- Spikelets 2-flowered; lower glume 2-3-toothed. **9. Eulaliopsis.**
- Spikelets 1-flowered; lower glume not 2-3-toothed :—
- Lower glume dorsally flattened or shallowly concave between the keels; upper lemma wider than the awn, 2-toothed at the apex; rhachis fragile; perennials. **10. Eulalia.**

Lower glume convex on the back at least at maturity; upper lemma stipitiform; rhachis more or less persistent; annuals. . .

11. Pseudopogonatherum-

Racemes solitary; upper glume and lower lemma both awned. . .

12. Pogonatherum.

Spikelets solitary, 2-flowered, sessile; pedicelled spikelets reduced to their pedicels.

13. Apocopis.

Spikelets of each pair different in sex and usually also in shape and size, the pedicelled male or barren:—

Racemes paired, digitate, scattered or in panicles:—

Racemes espatheate:—

Upper lemma of the sessile spikelet awned from the tip or from the sinus of the two-lobed tip; culms erect or geniculate; leaf-blades mostly linear:—

Racemes usually arranged in panicles or in whorls along the main axis:—

Pedicels without a translucent line; upper lemma awned from the sinus of 2-lobes:—

Spikelets dorsally compressed; lower glume more or less flattened on the back:—

Racemes few-noded.

14. Sorghum.

Racemes many-noded.

15. Pseudosorghum.

Spikelets laterally compressed or terete; lower glume rounded on the back, often muricate:—

Racemes composed of many pairs of spikelets.

16. Vetiveria.

Racemes usually composed of 1-sessile and 2-pedicelled spikelets.

17. Chrysopogon.

Pedicels with a median translucent line; upper lemma awned from the tip.

18. Capillipedium.

Racemes digitate, sub-digitate or scattered:—

Sessile spikelets of all pairs hermaphrodite and awned; lower glumes or sessile spikelets narrow, the latter not closely imbricate. . .

19. Bothriochloa.

- Sessile spikelets of lowest 1-3 pairs male or neuter, awnless; lower glumes of sessile spikelets broad, the latter closely imbricate. 20. *Dichanthium*.
- Upper lemma of sessile spikelets awned from low down on the back; dwarf grasses often with prostrate or ascending culms; leaf-blades short, lanceolate to ovate. 21. *Arthraxon*.
- Racemes supported by spathes :
Column of awn glabrous; lower glume of sessile spikelet 2-keeled :
Not aromatic; racemes paired or digitate, terminating the culm (and its branches); lowest pair of spikelets usually heterogamous. 22. *Andropogon*.
Aromatic; racemes paired, in compound panicles; lowest pair of spikelets homogamous. 23. *Cymbopogon*.
- Column of awn hairy; lower glume of sessile spikelet rounded on the sides. 24. *Hyparrhenia*.
- Racemes solitary :
Racemes of several pairs of spikelets, evenly spaced :
Column of awn glabrous, lower pairs of spikelets heterogamous, dissimilar, the sessile awned; rachis fragile throughout. 26. *Schizachyrium*.
Column of awn hairy; lower pairs of spikelets homogamous, similar, awnless, the rachis tough between them. 27. *Heteropogon*.
- Racemes of few pairs of spikelets, the lower 2 or more pairs male or neuter and forming a false involucre around the remainder :
Involucral spikelets persistent, short pedicelled or sessile, the inner spikelets deciduous; callus of fertile spikelets pointed.
Involucral spikelets usually 4, with 1 male flower or barren. 28. *Themeda*.
Involucral spikelets 6-9, with 2 male flowers. 29. *Germainia*.
Involucral spikelets (4) deciduous, pedicels long; callus of fertile spikelets very short, truncate or obtuse. 30. *Iseilema*.

Internodes of the rhachis usually stout and thickened upwards or throughout, or flattened; pedicels often similar to the internodes; spikelets 1-2-flowered; upper lemma awned or awnless.

Spikelets solitary, awned, very short-pedicelled, on the continuous rhachis of slender secund spike-like racemes.

31. Dimeria.

Spikelets paired, one sessile and the other pedicelled, rarely the pedicelled spikelet reduced to the pedicel :

Upper lemma usually awned (sometimes awnless in *Apluda*) :

Racemes composed of several to many internodes and pairs of spikelets :

Racemes paired, digitate or sub-digitate.

32. Ischaemum.

Racemes solitary.

33. Sehima.

Racemes reduced to 3 spikelets, partially enclosed by spathes.

34. Apluda.

Upper lemma always awnless :

Lower glume of all spikelets long-tailed, with the tail flat; racemes digitate or solitary; aquatic grasses with floating culms.

35. Vossia.

Lower glume not long-tailed :

Racemes several to many, very fragile; glumes quite smooth.

36. Thrysia.

Racemes always solitary :

Spikelets in pairs or threes :

Racemes tough or very slowly disarticulating; spikelets more or less alike.

37. Mnesithea.

Racemes readily disarticulating; spikelets more or less dissimilar :

Each internode of the rhachis with 2 sessile spikelets, at least in the lower part of the spike.

38. Hemarthria.

Each internode of the rhachis with one sessile and 1 pedicelled spikelet :

Sessile spikelets globose, pitted.

39. Hackelochloa.

Sessile spikelets not globose, unpitted :

Racemes cylindrical, symmetrical; spikelets different.

40. Rotthoellia.

- Racemes compressed, one-sided; spikelets similar. 41. *Coelorrhachis*.
 Spikelets solitary, sessile, the pedicelled suppressed; pedicels fused with the internodes of the rhachis. 42. *Ophiuros*.

1. ECCOIOPORUS Steudel.

Spikelets fusiform, disarticulating from the pedicels and leaving the rhachis and pedicels intact, 2-flowered. *Glumes* herbaceous, membranous to chartaceous, 7-9- (occasionally 12-) nerved, 2-toothed or shortly awned at the tip, hairy and scabrid on the back. *Lower floret* male or empty; lemma oblong; tip rounded, scaberulous; palea present or absent. *Upper floret* hermaphrodite; lemma hyaline, cleft to below the middle, awned; awn up to twice the length of the spikelet; palea hyaline, broadly lanceolate.

Tall grasses. *Leaf-blades* long, flat, scabrid, hairy, sparsely spreading; sheaths sub-compressed, striate, glabrous; ligule oblong, membranous. *Inflorescence* an oblong or ovate-oblong panicle; branches whorled, naked at the base, flowering towards the tips; pedicels clavate, with cupped tips, long and short.

Ecoioporus cotulifer A. Camus in Ann. Soc. Linn. Lyon, n.s. LXX (1923) 92. Syn. *Spodiopogon cotulifer* Hack., Mon. Androp. (1889) 187.

A perennial grass. *Culms* 80-150 cm. high, erect, sub-robust, 4-6-noded, terete, striate, simple, often dark purple in colour. *Leaf-blades* strongly narrowed at the base (almost petiolate in the lower ones), linear sub-lanceolate, 15-50 cm. long by 8-12 mm. wide, finely acuminate, flat, sub-rigid, spreading, green, a few tubercle-based hairs below, scabrid above; margins very scabrid, bearded at the base; lower sheaths sub-compressed, keeled, free from the culms, upper terete, lax, striate, very smooth; ligule oblong, 2-4 mm. long, obtuse, membranous, glabrous.

Panicle oblong or ovate-oblong, 15-20 cm. long, open, shining; tip nodding; common axis terete, glabrous; branches whorled, lower 2·5-7·5 cm. long, naked at the base, lax flowered, flowering at the tips, a few villae usual at the junc-

tion with the common axis; pedicels clavate, with cupped tips, the longer equal to a spikelet in length, the shorter about 1/3 the length of the spikelet. *Spikelets* linear-lanceolate, sub-fusiform, 5-6 mm. long, somewhat oblique; callus bearded with white hairs. *Lower glume* 6 mm. long, herbaceous, chartaceous, acute, minutely 2-dentate, (in long pedicelled spikelets mucronate) strongly 7-9-nerved, ciliate on the marginal nerves, the rest scaberulous, shortly awned. *Upper glume* chartaceous, lanceolate, tip minutely 2-dentate and mucronate between the teeth (especially in the longer pedicelled spikelets) obscurely carinate, convolute, 7-nerved, hairy and scabrid on the back. *Lower floret* empty; lemma 4.5 mm. long, oblong, tip rounded, scaberulous above the middle, not ciliate; palea occasionally absent, when present lanceolate, 2-toothed, ciliate. *Upper floret* hermaphrodite; lemma 4 mm. long, linear, hyaline, cleft to below the middle into 2 setiform lobes; awn slender, 12-15 mm. long; palea 4 mm. long, broadly lanceolate, 2-toothed, enervate, glabrous. *Lodicules* subconnate; anthers 3 mm. long.

Quite common in Upper Shillong, on the banks of the river flowing from the Agricultural Farm to the Elephant Falls. Collected by C. B. Clarke at Soyung and Bogapani. Balipara Frontier Tract, 8,000 ft. On the whole a rare grass.

2. IMPERATA Cyril.

Spikelets all alike, generally 2-nate (one short, the other long pedicelled) on the continuous branches of a spike-like, narrowly thyrsiform panicle, disarticulating from the pedicels. *Florets* 2, the lower reduced to an empty lemma. *Glumes* sub-equal, membranous, 3-4-nerved, rarely nerveless, enveloped by very long silky hairs from the obscure callus and the lower portion of both glumes. *Lemma* of the lower floret generally much smaller than the glumes, hyaline; lemma of upper floret as long, hyaline, awnless, rarely absent; palea broad, hyaline, nerveless. *Lodicules* 0. *Stamens* 1-2. *Styles* connate below; stigmas linear, exserted from the top of the floret. *Caryopsis* oblong; embryo half the length of the grain or more.

Perennial; basal-leaves crowded and like those of the innovation shoots, long; panicle silvery silky.

Imperata cylindrica (Linn.) P. Beauv., Agrost. (1812) 165. Syn. *I. arundinacea* Cyrill., Pl. Rar. Neap. fasc. 2 (1792) 26.

A perennial grass, very variable in size, some of the depauperate forms scarcely 10 cm. tall while the forms of the open plains may reach 2·5 m. or more. *Culms* solid, glabrous, fistular at the base; nodes usually densely bearded with erect white hairs. *Leaves* as variable as the culms, up to 1·5 m. long, narrowed towards the base, tapering to an acuminate tip, scabrid on the margins, covered with white villae at the base; midrib more than half the blade at the base; sheaths rather loose, glabrous or slightly pubescent, longer than the internodes, ligules membranous, ciliate, dorsally silky, erose or cleft.

Inflorescence a spike-like panicle, 3-30 cm. long, cylindric, very dense; pedicels very slender, swollen at the tips, covered with long fine hairs. *Spikelets* lanceolate, 3 mm. long, both spikelets of each pair similar; callus hairs, white, soft, 2-3 times as long as the spikelets. *Lower glume* lanceolate, membranous, firmer towards the base, hyaline at the apex, 3-9-nerved, dorsally villous; villae 2-3 times as long as the glume; upper glume keeled, as long as the lower. *Lower floret* empty; lemma, nerveless, hyaline, acute, ciliate, 1·5-2 mm. long, epaleate. *Upper floret* hermaphrodite; lemma as long, ovate-lanceolate, hyaline, nerveless, acute or denticulate, minutely ciliate or glabrous. *Anthers* 2, 2·5-3 mm. long, orange. *Stigmas* 2, long, purple.

Very common, plains to 6,000 ft. A useful thatching grass which is not relished by stock unless very young.

3. MISCANTHUS Anderss.

Spikelets 2-rate at each node, one long the other shortly pedicelled, awned or muticous, slightly dorsally compressed, articulate on the pedicels. *Glumes* 2-muticous; the lower almost flat with more or less inturned margins, often 2-4-nerved; upper glume similar but more convex, 1-3-5-nerved. *Lower floret*; lemma hyaline, empty, more or less bifid. *Upper floret* hermaphrodite; lemma hyaline, 2-toothed or bifid at the apex, awned from between the teeth, very rarely entire

or muticous; palea shorter, narrow, hyaline, nerveless, sometimes much reduced; lodicules cuneiform, glabrous, emarginate at the apex. *Stamens* 2-3. *Styles* free; stigmas rather short. *Caryopsis* shortly oblong, ventral face flattish, dorsal surface somewhat convex; embryo half as long as the caryopsis.

Tall perennial grasses. *Culms* simple, erect, striate. *Leaves* long. *Inflorescence* sub-compound, glabrous or silky in an ample panicle or corymb, made up of lengthy false spikes, simple or branchy, numerous; rhachis glabrous, tough, not articulate, carrying many spikelets; pedicels glabrous, callus often with long hairs.

Key to the species of *Miscanthus*.

- | | | |
|-----------------------------------------------------------------------------------------------------|----------|---------------------------|
| Racemes many, densely crowded, 12·5-17·5 cm.
long; hairs of callus much longer than
spikelet. | | I. <i>M. nepalensis</i> . |
| Racemes few, 5-7·5 cm. long; hairs of callus
not longer than spikelet. | | 2. <i>M. nudipes</i> . |

1. *Miscanthus nepalensis* Hack., Mon. Androp. (1889) 104.

A perennial grass with extravaginal innovations. *Culms* 60-150 cm. tall, slender, terete, puberulous below the panicle, elsewhere glabrous. *Leaf-blades* 30-50 cm. long, linear from a narrowed base, 6-10 mm. wide, flat, rigid, erect or spreading, green, very glabrous; median nerve prominent; sheaths terete, striate, often hairy below the collar, otherwise glabrous; ligule 2 mm. long, truncate, membranous.

Panicle flabelliform, 10-15 cm. long, spreading; the common axis glabrous except at the nodes, shorter than the branches. *Racemes* 8-12 cm. long, capillary, nodding, corymbose-fastigiate, fulvous haired; rhachillæ sub-capillary, scaberulous. *Pedicels* sub-capillary, erect or spreading, scarcely swollen at the tips, scaberulous, some equaling the spikelets in length, others half as long. *Spikelets* 2·2-5 mm. long, ovate-lanceolate, pale brown. *Lower glume* 2·25 mm. long, chartaceous, membranous, obtuse, apex hyaline, emarginate, hairy on the lower half of the margins with hairs of unequal length, the longer about 2-3 times, the length of the glume; hairs fulvous; margins hardly inflexed; dorsum minute-

ly scaberulous. *Upper glume* 2·75 mm. long, ovate-lanceolate, acute or sub-acute; margins hyaline, 1-nerved; keel very scabrid; margins scaberulous. *Lower floret* empty; lemma 2·5-3 mm. long, broadly oblong, usually lanceolate, obtuse, often denticulate, nerveless, glabrous. *Upper floret* hermaphrodite; lemma equal to the lower lemma, linear-lanceolate, acutely 2-toothed, one-nerved, glabrous; awn very slender, 9-10 mm. long, lanceolate, acute, nerveless, glabrous. *Stamens* 2-3; stigmas exserted below the apex of the spikelet. *Caryopsis* oblong, purple-black, plano-convex or round in section, 1·5 mm. long. *Caryopsis* not always plano-convex but distinctly fusiform, oblong, ellipsoid.

Common in Assam. Especially in the Khasi Hills and also in the Naga Hills, 4,500-7,000 ft.

2. **Miscanthus nudipes** Hack., Mon. Androp. (1889) 109.

Culms sub-robust, terete, silkily pubescent below the panicle. *Leaf-blades* linear from a scarcely narrowed base, 20 cm. long or more, 4·5 mm. wide, flat, rather rigid, spreading, green, pubescent on both surfaces; margins smooth; sheaths terete; upper nodes pubescent, lower glabrous; ligule obtuse, ciliolate, reddish, 2-3 mm. long.

Inflorescence made up of 8-10 racemes, fasciculate, or with a common axis, 8-10 cm. long, sub-robust, spreading, brownish, laxly grey-pilose; lower nodes 8-10 mm. distant, upper 2-4 mm.; rhachis very glabrous, triquetrous, compressed; internodes 3-4 mm. long; long pedicels 2·5-3 mm. long, short 1·1-1·5 mm. long, sub-clavate, very glabrous. *Spikelets* oblong, 5·5-5 mm. long, brownish, above blackish-purplish, callus bearing grey hairs 2/3 the length of the spikelet. *Lower glume* 4 mm. long, chartaceous, oblong, apex hyaline, broadly truncate or divided into 2 teeth, 4-ribbed on the convex dorsum, greyish; hairs 3-3·5 mm. long. *Upper glume* 4-5 mm. long, chartaceous, lanceolate-oblong, obtuse, muticous, 5-nerved, laxly pilose on the keel above; apex sub-hyaline, ciliate. *Lower floret* empty; lemma 4 mm. long by 1·5 mm. wide, broader above, acute; apex erose, nerveless, glabrous. *Upper floret* hermaphrodite; lemma linear, broad-

ly oblong-lanceolate, obtuse, tip ciliate, 2·5 mm. long, acute, entire or toothed, 1-nerved, glabrous; awn 6-8 mm. long, erect, scabrous, brownish; palea 3·5 mm. long, linear lanceolate, acute, scabrid, nerveless. Stamens 2; anthers 3 mm. long. Styles elongate; stigmas linear, purple, exserted from the apex of the spikelets.

Collected by Griffith in the Mishmi country.

4. SCLEROSTACHYA A. Camus.

Spikelets in pairs, one long, the other short-pedicelled on the tough, secondary, filiform branches of an erect, terminal panicle, ovate-oblong or slightly obovate-oblong, obtuse, deciduous from the pedicels. *Short* pedicelled spikelets; glumes coriaceous, brown, shining, the lower flat on the back, with incurved margins, the upper keeled, acute, with margins ciliate above. *Florets* two; lower male or empty; lemma hyaline, ovate-oblong, ciliate at the top, paleate; upper hermaphrodite; lemma hyaline; palea long. Long pedicellate spikelets similar to the short, sometimes female.

Perennial grasses with moderately tall, fistular stems and long rigid leaves. Inflorescence a linear-oblong panicle, erect, dense.

Key to the species of *Sclerostachya*.

- | | |
|--------------------------------------------------|------------------------|
| Panicle stout, erect; leaves long broad .. | 1. <i>S. fusca</i> . |
| Panicle slender, drooping; leaves short, narrow. | 2. <i>S. milroyi</i> . |

1. *Sclerostachya fusca* A. Camus in Lecomte, Flor. Gen. de l'Indo-Chine, VII (1922) 243. Syn. *Saccharum fuscum* Roxb., Flor. Ind. I (1832) 236.

Culms from 1·5 to 3 m. tall, robust, reed-like, fistular, appressed-pubescent near the top. *Leaf-blades* with a contracted base, sub-lanceolate, linear, setaceous-acuminate, 1 m. long or more, 2-4 cm. wide, flat, rigid; base erect, glabrous on both surfaces; margins very scabrid, median nerve prominent as a white line above; primary nerves 7-9; sheaths longer than the internodes; margins ciliate; ligules rounded, 3 mm. long, brown, membranous, ciliate.

Inflorescence a linear-oblong panicle, straight, dense, 30-60 cm. long; common axis angular, pubescent, bearded at the nodes; primary branches often solitary, carrying at the base secondary branches which are alternate, fasciculate, long, simple or branching at the base, filiform, pubescent; racemes of spikelets 6-10 cm. long, slender, sessile, erect, spreading, nodding at the summit, somewhat glabrous; rhachis articulate but tough, filiform, rather flexuous. *Spikelets* ovate-oblong, or obovate, 3 mm. long, 1.5 mm. broad, brown, 2-nate, one shortly pedicelled the other with a long pedicel, falling finally from the pedicels; callus short with grey hairs which are almost half as long as the spikelet. *Lower glume* 3 mm. long, sub-coriaceous, shining, obtuse, entire, with margins narrowly inflexed; folds ciliate; back flat or slightly depressed above the middle, very glabrous, obscurely 2-3-nerved. *Upper glume* acute, keeled, glabrous, margins ciliate above, 1-nerved. *Lower floret* male or empty; lemma about 3 mm. long, ovate-oblong, obtuse, nerveless, stiff ciliate at the apex. *Upper floret* hermaphrodite; lemma 2.5 mm. long, similar to lower lemma; margins long and rigidly ciliate; palea much smaller, ovate, ciliate; lodicules glabrous; anthers 1.5 mm. long.

Very common in Lakhimpur and Sibsagar.

2. Sclerostachya milroyi Bor, Ind. For. Rec. (Bot.)
1. 3. (1938) 85.

Culms up to 1.5 m. tall, slender, appressed pubescent below the panicle. *Leaf-blades* linear-lanceolate, tapering to a fine setaceous point from a contracted base, up to 35 cm. long, 8 mm. broad, glabrous, somewhat rough on both surfaces; margin thickened and scabrid; median nerve very prominent, broad, white; primary nerves four; sheaths longer than the internodes, smooth, hirsute near the auricled mouth, otherwise glabrous, ciliate on the margins; ligule obtuse, almost triangular, 2 mm. long, smooth inside, brown, densely hirsute on the back and ciliate on the margins.

Inflorescence a weak, lax, linear, oblong panicle, spreading and loose or contracted and dense, 15-20 cm. long, 5-12 cm. broad. *Primary axis* pubescent, smooth, rounded or

angular, shallowly channelled, bearded at the nodes. Primary branches fascicled at the nodes, frequently branched; secondary branches fascicled at the pubescent nodes, spreading, pubescent, filiform. Racemes of spikelets up to 16 cm. long, closely spiculate. Spikelets in pairs, narrowly elliptic, ovate-oblong, obovate or oblong, acute, 3-4 mm. long, both pedicelled, articulate on the pedicels; pedicels 1.2-5 mm. long, angled, smooth and glabrous, expanded into a cup at the apex. Callus with white hairs up to 1.5 mm. long. Lower glume; shape of the spikelet, 2-nerved, smooth and glabrous on the back between the nerves, long villous between the nerves and the margin, membranous or sub-coriaceous, back flat or slightly depressed above the middle, margins inflexed, ciliate. Upper glume acute, 3.5 mm. long; back keeled or rounded, very smooth and glabrous, ciliate on the margins above, 1-nerved. Lower floret barren; lemma hyaline, ovate-acute, 3 mm. long, ciliate at the apex, faintly 5-7-nerved, epaleate. Upper floret hermaphrodite; lemma ovate-lanceolate, up to 3 mm. long, ciliate at the apex, hyaline, faintly 5-nerved; palea usually absent, if present, minute. Stamens 3; anthers 1.5 mm. long. Stigmas feathery, exserted at anthesis. Lodicules 2, cuneate, truncate, upper margin bluntly toothed.

Sibsagar, Assam.

5. NARENGA Bor.

Narenga Bor.; genus novum graminearum distinctum, a *Saccharo* Linn. glumis inferioribus prorsus coriaceis, glumis superioribus (apice membranaceo excepto) etiam coriaceis, distinguendum.

Spiculae omnes similes, binae, una sessilis, altera pedicellata, rhachi articulata racemorum paniculatorum dispositæ; pedicellatæ a pedicello solutæ, sessiles cum rhacheos articulo accumbente pedicellocque demum decidentes. *Anthæcia* 2, inferius ad lemma reductum, superius hermaphroditum. *Glumæ* æquales, coriaceæ vel secundaria apice membranacea; inferior dorsi plana, marginibus involutis, breviter ciliatis; superior carinata, apice membranacea. *Lemmata* hyalina;

superius truncatum, paleatum, sine arista. *Lodiculae* 2. *Stamina* 3, lateraliter exserta.

Gramina perennia, alta, foliis planis, scabris. *Culmi* nodis dense barbati. *Panicula* angusta, densa; pili spiculis breviores.

NARENGA * Bor.

Spikelets all alike, 2-nate, one sessile the other pedicelled on the articulate fragile rhachis of panicle racemes, the pedicelled falling from their pedicels, the sessile together with the contiguous joint of the rhachis and pedicel. *Florets* 2; the lower reduced to an empty lemma; upper hermaphrodite. *Glumes* equal in length, coriaceous, brown, shining; lower flat on the back, margins laxly inflexed, short haired on the margins; upper keeled, membranous at the top. *Lemmas* hyaline; upper truncate, awnless paleate. *Lodicules* 2. *Stamens* 3. *Stigmas* laterally exserted.

Tall perennial grasses with long flat scabrid leaves. *Culms* densely bearded at the nodes. Panicle narrow dense; hairs shorter than the spikelets.

Narenga porphyrocoma* (Hance) Bor comb. nov. Syn. *Saccharum narenga* Wall Cat. no. 8856; *Eriochrysis narenga* Nees ex Steud., Syn. Pl. Glum. (1854) 411; *Eriochrysis porphyrocoma* H. F. Hance, Jour. Bot. XIV (1876) 294; *Saccharum porphyrocomum* (Hance) Hack., Mon. Androp. (1889) 120.

Culms 2-2·5 m. tall, erect, somewhat slender, rounded, appressed silky below the panicle and on the nodes. *Leaf-blades* narrow at the base, flat, glabrous above, with tubercle based hairs below and very scabrid, 30-60 cm. long by 6 mm. broad, the upper reduced and subulate; median nerve strong; margins very scabrid; sheaths often little shorter than the internodes, tubercular, scabrous with long hairs near the throat and on the margins or hairy all over; ligules rounded, ciliolate, 2-3 mm. long.

Inflorescence a narrow dense panicle, almost linear, erect, woolly, purplish or whitish, 30-45 cm. long; common axis robust, glabrous, minutely scaberulous, bearded at the nodes;

* Published in Ind. For. LXVI (1940) 267.

primary branches 2-4-nate, filiform, appressed, often simple at the base, glabrous, secondary branches alternate; internodes of the rhachis fragile, about 1/3 shorter than the spikelet and equaling the pedicel, linear, clavate, hairy at the base; margins ciliolate at the base, glabrous at the summit. *Sessile spikelets* oblong, brown, 2·5-3 mm. long; callus small with abundant rigid hairs. *Glumes* coriaceous: lower 2·5-3 mm. entire, margins narrowly and laxly inflexed at the summit, short haired on the margins, back flat; the upper 2·5-3 mm. long, membranous at the summit, broadly oblong, keeled, obtuse, margins ciliate towards the top, obscurely 3-nerved. *Lower floret* empty; lemma 2·5-3 mm. long, oblong, obtuse, ciliate, nerveless. *Upper floret* hermaphrodite; lemma; 2-3 mm. long, linear-oblong, obtuse or truncate, emarginate, nerveless, ciliate; palea about as long as the ovary; lolicules glabrous; anthers 1·5 mm. long. *Styles* as long as the linear oblong stigmas, blackish purple, 1 mm. long.

It has long been felt by agrostologists that the retention of *Saccharum narenga* Wall. in the genus *Saccharum* was anomalous owing to its possession of morphological characters which are quite distinct from those of species accepted as members of that genus. The most important of these is the coriaceous glumes (slightly membranous at the tip in the case of the upper glume) in contrast to the membranous glumes, at most slightly coriaceous at the base, of the other species.

The late Dr. Otto Stapf treated *S. narenga* as a distinct genus in the Kew Herbarium. Dr. G. Bremer (Proceedings of the Third Congress of the International Society of Sugarcane Technologists, (1930) 408) remarks: "It must be stated, however, that *Saccharum narenga* has only 15 chromosomes in the haploid phase. According to Professor Jeswiet it is uncertain whether this species is indeed a *Saccharum*, since it is a grass with external characters that differ in a certain degree from those of *Saccharum*." I. H. Burkill (Economic Products of the Malay Peninsula, II (1935) 1923), states under *Saccharum* "It must be explained that the delimitation of *Saccharum* from the most closely allied genera has undergone changes recently by which, in the first place, the genus, as it stood in the Flora of British India in 1897, has been divided into three genera: (1) *Saccharum*, which includes *S. spontaneum* Linn. and *S. arundinaceum* Retz.; (2) *Narenga*, into which *S. narenga*, Buch-Ham. has been transferred and (3) *Sclerostachya* with *S. fuscum* Roxb. and *S. ridleyi* Hack." I have been unable to find any reference in the

literature to the creation of a genus to include *S. narenga* and Mr. C. E. Hubbard of Kew has not been able to throw any light upon this question.

As *Narenga* cannot be used for the specific epithet the next available is "porphyrocoma" since *Eriochrysis porphyrocoma* Hance is a synonym of *Saccharum narenga* Wall. Hackel kept *Saccharum porphyrocomum* (Hance) Hack. (*Eriochrysis porphyrocoma* Hance) distinct in his monograph on the *Andropogoneæ* but he did not see Hance's specimens and only copied his description.

Dr. E. K. Janaki Ammal has been good enough to place at my disposal the result of her researches into the cytology of *Saccharum* and closely allied genera.

<i>Saccharum arundinaceum</i>	$2n = 40$.
<i>S. officinarum</i>	$2n = 80$.
<i>Sclerostachya fusca</i>	$2n = 48$ and 96.
<i>Imperata cylindrica</i>	$2n = 20$.
<i>Narenga porphyrocoma</i>	$2n = 30$.

Saccharum spontaneum (E. J. Janaki Ammal, Ind. Jour. Agric. Sc. VI (1936) 1), in so far as its Indian forms are concerned, has been shown to form a polyploid series with the following chromosome numbers $2n = 48, 56, 64, 80$.

6. SACCHARUM Linn.

Inflorescence a silky, often a silvery-silky panicle. *Spikelets* all alike, surrounded by hairs, one sessile the other pedicelled on the articulate fragile rhachis of panicle racemes; the pedicelled falling from their pedicels, the sessile deciduous together with the contiguous joint of the rhachis and pedicel. *Florets* 2; the lower reduced to an empty lemma; upper hermaphrodite. *Glumes* equal, often chartaceous to sub-coriaceous at the base, membranous to sub-hyaline upwards; lower with inflexed margins in the sessile spikelet, usually with an even number of nerves; upper 1-3-5-nerved. *Lemmas* hyaline; upper with a terminal, bristle-like, usually straight awn, or mucronate; *Iodicules* 2, cuneate. *Stamens* 3. *Stigmas* laterally exserted. *Caryopsis* oblong to sub-globose; embryo short to half the length of the grain or more.

Perennial herbs, robust, tall to very tall, usually in damp places. *Culms* erect, round. *Leaves* narrow, flat, often rolled when dry.

Key to the species of *Saccharum*.

- Stem silky below the panicle. 1. *S. spontaneum*.
 Stem glabrous below the panicle :—
 Lower glume dorsally villous.
 Joints 3·5-4 mm. long; pedicels 2·2-5 mm.
 long; sessile spikelets 2·5-2·7 mm. long. 2. *S. arundinaceum*.
 Joints 6-7 mm. long; pedicels 2·5-3·5 mm.
 long; sessile spikelets 3-4 mm. long. . . . 3. *S. procerum*.
 Lower glume glabrous. 4. *S. officinarum*.

1. *Saccharum spontaneum* Linn., Mant. II (1771)
 183.

Rhizome thick. *Culms* 1-4 m. erect, with several nodes, solid, smooth, polished, glabrous, with silky appressed hairs below the panicle, densely waxy below the nodes, slender. *Leaf-blades* erect, rigid, coriaceous, glaucous, narrowly linear-acuminate, capillary at the tip, very glabrous except sometimes at the base, smooth at least below; margins scabrid, often involute, 45-170 cm. long, 4-5 mm. broad at the most, the upper scarcely shorter; sheaths auricled, glabrous, except sometimes towards the throat and on the margins, often blotched reddish-black inside; ligule ovate, membranous.

Inflorescence a lanceolate shaped panicle, dense, somewhat contracted, slender; common axis slender, fragile, silky, almost glabrous except for appressed hairs at the summit; primary branches slender, 5-10 cm. long, the lower 4-5-nate, the upper 1-2-nate; secondary branches from the base, simple or branched, filiform, silkily-hairy, the upper spiculate to the base, the lower naked; pedicels ciliate, somewhat like the internodes of the rhachis, 1·5-3 mm. long. *Spikelets* 3-6 mm. long, lanceolate, base often sub-glabrous, muticous, the pedicelled often more acute than the sessile; callus small, with silky hairs twice to several times the length of the spikelet. *Lower glume* 3-6 mm. long, lanceolate-acuminate or subulate, membranous, hyaline, but sub-indurated and coriaceous at the base, entire or 2-toothed, margins smooth or ciliate, narrowly inturned, glabrous on the back, 2-nerved; upper glume equalling the lower, almost of the same texture, oblong-ovate or broadly lanceolate, acuminate, often mucronate, keel and margins ciliate, 1-nerved. *Lower floret* empty; lemma 3-6 mm. long, ovate-lanceolate, acute or somewhat obtuse,

ciliate, nerveless. *Upper floret* hermaphrodite; lemma variable, often reduced, nerveless, ciliate or not; palea small about the size of the lodicules, ovate, ciliate, lodicules ciliate on the margins, often with one long hair. *Stamens* linear, 1·5-2 mm. long. *Stigmas* oblong, longer than the style.

A good fodder for buffaloes; leaves used for thatching. A very common grass in Assam being found in plains and hills. This is a very variable grass and an investigation by Dr. Janaki Ammal has shown that the Indian forms are a polyploid series with chromosome numbers ($2n$) varying from 48 to 80 (vide Ind. Jour. Agri. Res. VI (1936) 1).

2. *Saccharum arundinaceum* Retz., Obs. IV (1786)

14.

A very large grass growing in clumps. *Culms* up to 6 m. tall, glabrous, smooth; internodes long; nodes smooth and glabrous. *Leaf-blades* up to 1·5 m. long, 5 cm. wide, with a midrib at the base up to 1/3 the width of the blade, lanceolate-linear tapering to a very fine point, villous at the base only for a short distance on the midrib; margins very scabrid; upper leaves much reduced and often filiform; sheaths glabrous, striate, stout: ligule a truncate membrane.

Inflorescence a large silky panicle up to 60 cm. long, pink-white or silvery; axis glabrous; branches tufted, alternate or sub-virgillate. *Sessile spikelets* 2·5-2·7 mm. long: pedicels 2·2-5 mm. long; joints of the rhachis 3·5-4 mm. long. *Callus* furnished with hairs as long as the spikelet. *Sessile* spikelet; *lower glume* chartaceous with a few villosa on the back which overtop the spikelet. *Upper glume* glabrous. *Lower floret* male or neuter; lemma hyaline, as long as the spikelet, epaleate. *Upper floret* hermaphrodite; lemma hyaline, half the length of the spikelet, contracted into a short mucro which is not exserted; palea quadrangular, small, half as long as the lemma, ciliate. *Pedicelled* spikelet: glumes dorsally villosa. *Flowers* at the end of the rains.

According to Parker, Ind. For. LVI (1930) 341, *S. arundinaceum* Retz. only occurs as a cultivated plant. It seems to be wild in Assam.

3. Saccharum procerum Roxb. Fl. Ind. I (1832) 243.

A very tall grass. *Culms* up to 4·5 m. solid, terete, glabrous and smooth. *Leaf-blades* up to 1·5 m. long, 5 cm. wide, linear-lanceolate, tapering to a fine point, very scabrid on the margins; midrib occupying more than $\frac{1}{2}$ the width of the blade at the base and covered with dense villæ from the ligule 10 cm. up the blade; sheaths glabrous; ligule membranous.

Inflorescence a large silvery or grey, rather loose panicle. *Axis* smooth and glabrous; rhachis-joints 6·7 mm. long; pedicels 2·5-3·5 mm. long. *Sessile* spikelets 3·4 mm. long. For the rest as in *S. arundinaceum* Retz.

In Ind. Forester LVI (1930) 340, R. N. Parker points out that *S. procerum* Roxb. is the wild plant of Assam, Bengal and Burma. This grass flowers in January by which time the inflorescences of *S. arundinaceum* are mature. Owing to the longer joints and pedicels the panicles of *S. procerum* Roxb. are much looser than those of *S. arundinaceum*.

S. procerum Roxb. is very common in Assam and is found in wet low-lying places in the plains and also in the hills up to an altitude of 3,000 ft. This species is probably the same as *Saccharum bengalense* of Retzius. Obs. V. (1789), 16. If so, this name should take precedence.

4. Saccharum officinarum Linn., Sp. Pl. (1753) 54.

Culms 2·6 m. tall, erect, glabrous or with appressed hairs below the panicle, waxy at least below the nodes, simple or branched. *Leaf-blades* rigid, linear-lanceolate, acuminate, base narrower, spreading, drooping at the tip, rather glaucous on the lower surface, scabrous, particularly above and on the margins, 1·5 m. long by 6 cm. broad, the upper scarcely shorter; median nerve thick, white above; sheaths pubescent towards the throat or at first covered with appressed hairs; ligule very short, membranous, ciliate.

Inflorescence a very large panicle, ovate-pyramidal, spreading, dense; principal axis glabrous, nodes bearded, smooth, rarely with appressed pubescence, channelled; pri-

mary branches slender, 5-10 cm. long, more or less verticillate, filiform, pubescent at the base, glabrous; minutely scaberulous at the top, bearded towards the nodes, base shortly naked; secondary branches simple, distant; internodes fragile, equaling and exceeding the spikelet in length, somewhat thickened at the top, very glabrous between the angles; pedicels glabrous. *Spikelets* linear-oblong, pale or almost brownish, muticous, 3·5-4 mm. long, surrounded by dense white silky hairs 1·5-2 mm. long; callus covered with dense white silky hairs 7-12 mm. long. *Lower glume* 3·5-4 mm. long, papyraceous-membranous, acute, entire; margins broadly but laxly inserted, very obscurely nerved or nerveless. *Upper glume* 3·5-4 mm. long, membranous, lanceolate, acute, 1-3-nerved, keels scabrous above, glabrous or ciliate. *Lower floret* empty; lemma almost as long as the spikelet, lanceolate, acute, hyaline, membranous, nerveless. *Upper floret* hermaphrodite; lemma very reduced or absent; palea lanceolate, rather acute, ciliate at the apex.

Cultivated in both valleys.

7. ERIANTHUS Michx.

Spikelets all alike, 2-nate, one sessile the other pedicelled, on the articulate and usually fragile rachis of panicle racemes, the pedicelled falling from their pedicels, the sessile deciduous with the contiguous joint of the rachis and the pedicel. *Florets* 2; the lower reduced to an empty lemma; the upper always hermaphrodite. *Glumes* equal, membranous to coriaceous; lower dorsally flattened, more or less distinctly 2-keeled, with inflexed margins and a variable number of intracarinal nerves, upper 1-3-nerved. keeled. *Lemmas* hyaline, lower muticous or mucronate, upper awned; palea small, hyaline, nerveless. *Lodicules* 2, cuneate. *Stamens* 2-3. *Sigmas* usually laterally exserted. *Grain* oblong to linear-oblong.

Perennial, erect, often gigantic grasses. *Blades* long, narrow, midrib very stout; ligules membranous. *Panicle* much branched, often large, silky and showy; spikelets usually villous, with an involucre of hairs from the base.

Key to the species of *Erianthus*.

Upper lemma entire, narrowed into the awn :—

Culms glabrous below the panicle. .. 1. *E. elephantinus*.

Culms silky-villous below the panicle. .. 2. *E. fulvus*.

Upper lemma 2-toothed or 2-lobed :—

Lower glume dorsally glabrous. .. 3. *E. longisetosus*.

Lower glume dorsally villous :—

Spikelets 3·5 mm. long; lower glume dorsally villous all over. .. 4. *E. chrysotrix*.

Spikelets 5·6 mm. long; lower glume villous below the middle. .. 5. *E. hookeri*.

1. *Erianthus elephantinus* Hook. f., F. B. I. VII (1897) 122.

Culms very tall, up to 4 m., robust, stout, smooth and glabrous. *Leaf-blades* up to 1·5 m. long, 5 cm. broad, smooth on both surfaces; median nerve very prominent; margins cartilaginous and roughly scabrid; sheaths up to 1 m. long, smooth and glabrous; ligule a fringe of long straight hairs.

Panicle up to 40 cm. long; rhachis glabrous, polished; lower nodes 10 cm. apart; branches numerous, lower fascicled and half whorled, 15-20 cm. long; rhachis few flowered, capillary, fragile; joints and pedicels half as long as the spikelets or longer, villously-ciliate, hairs 2·5-4 mm. long, grey or purplish, top cupular. *Spikelets* ovate-lanceolate, pale, 3·5-4 mm. long; callus bearded. *Lower glume* 3-5-nerved, narrowly ovate-lanceolate, tip 2-toothed, dorsally flat and sparsely hairy; keels scabrid; *upper glume* lanceolate, acuminate, sub-aristate, 3·5-4 mm. long, 1-nerved. *Lower floret* empty; lemma 3·5 mm. long, stiff, hyaline, 1-nerved, ciliate; margins recurved. *Upper floret* hermaphrodite; lemma 2·5 mm. long, quite glabrous, awn 2·5 mm.; palea as long as the lemma or sometimes absent.

A gigantic and gregarious grass found in the plains of Assam.

2. *Erianthus fulvus* Nees ex Steud., Syn. Pl. Glum. (1854) 409.

Culms 1-2 m. high, robust, many noded, with silky appressed hairs below the panicle. *Leaf-blades* linear from

a slightly narrowed base, setaceous-acuminate, 30-70 cm. long, 8-16 mm. broad, flat, rigid, glabrous except at the base, glaucous, scabrous below, smooth, green above; margins scabrid; median nerve prominent; sheaths striate, glabrous except towards the collar where the pubescence is silkily appressed, nodes sometimes bearded; ligule rotund-truncate, 1-2 mm. long, fuscous, membranous, long-ciliate.

Panicle erect, short, oblong, 20-25 cm. long, very dense at first, mauve-purple, fading to a fulvous colour, decom-pound; common axis villous; primary branches solitary, up to 7 cm. long, spikelets crowded; joints 8 to 10; pedicels filiform, villous, half as long as the spikelets or more. *Sessile spikelets* 2·5-3 mm. long, lanceolate, brownish; callus hairs 1 cm. long, pale towards the top; *lower glume* chartaceous, membranous, the hyaline tip abruptly acuminate, entire; margins inflexed below the apex or not; back flat, very glabrous, 2-nerved, 2·5 mm. long; *upper glume* rather longer, 2·5-3 mm. long, acute or 2-mucronulate, glabrous; margins ciliate. *Lower floret* empty; lemma 3 mm. long, linear-lanceolate, acute, ciliate; palea absent. *Upper floret* hermaphrodite; lemma 2 mm. long, ovate-lanceolate, glabrous, 1-nerved; awn 6-8 mm. long; palea as long as the glume or shorter (.5 mm.) or entirely absent. Pedicelled spikelet similar to the sessile but lower glume sometimes with spinose hairs. *Caryopsis* obovate, ellipsoid brown to golden in colour, 1·5 mm. long.

Commun in the Khasi and Naga Hills, 4-6 000 ft.

3. *Erianthus longisetosus* Anderss. ex Benth. in Journ. Linn. Soc. XIX (1831) 67.

Culms 2-2·5 m. tall, stout, solid, terete, reed-like, simple or branched from a stout rhizome, almost woody below, smooth and glabrous, naked below the panicle. *Leaf-blades* 30-100 cm. long, flat, up to 1.5 cm. wide, lanceolate, tapering to a fine tip from a gradually narrowed base, smooth and glabrous on both surfaces or with short appressed hairs; margins very scabrid; sheaths rather loose, strongly striate, covered with appressed tubercle-based hairs; margins hyaline,

smooth and glabrous, hairy at the junction with the blade; ligule rounded and shortly ciliate.

Panicle 15-45 cm. long, made up of many, long, densely packed, solitary or binate, long divided, soft, drooping racemes clothed with pale, reddish or golden brown hairs, spreading at anthesis; rhachis nodes bearded or glabrous; joints and pedicels slender, about as long as the spikelets, densely ciliate with long hairs of unequal length, 3-8 mm. long; pedicels slightly thickened upwards, cupped. *Spikelets* 4.5-5 mm. long, oblong-lanceolate in shape, golden brown in colour, bearded on the callus, (hairs 3 mm. long), articulating from the pedicels, rather pale at the tips. *Pedicelled spikelets* with long hairs from the lower portion of the dorsal surface of the glumes: the glumes of the sessile spikelets are usually glabrous. *Lower glume* oblong-lanceolate; margins closely appressed and rather membranous, the rest of the glume being chartaceous, 4.5-5 mm. long, glabrous, 2-4-6-nerved; nerves often anastomosing; apex truncate or sub-two-toothed; upper glume oblong-lanceolate, 1-nerved; apex and margins hyaline, ciliate, glabrous; apex apiculate or rarely very shortly awned. *Lower floret* empty; lemma oblong, hyaline, ciliate. *Upper floret* hermaphrodite; lemma very variable, about 3.5 mm. long, very narrow; awn up to 2 cm. long; palea small, hyaline, oblong, truncate.

Common in the hills but is also found in the foot-hills.

4. *Erianthus chrysothrix* Hack. in Oestr. Bot. Zeitschr. XLI (1891) 6.

Culms 1-1.5 m. tall, solid, smooth, rusty tomentose below the large panicle. *Leaves* narrowed at the base, linear, 40-80 cm. long, 1-1.5 cm. wide, tapering to a very fine point, rigid, green; tip bending over, glabrous or sparsely hirsute; margin very scabrid; margins of the sheaths covered with dense, hirsute, rusty coloured hairs, rest glabrous and smooth save the upper which are covered with appressed hairs; ligule short, membranous, with short dense hairs behind.

Panicle linear oblong, 30-40 cm. long, erect, contracted, densely flowered, covered with a very dense golden brown or rusty tomentum; nodes of the rhachis reddish-bearded and

ciliate; branches sub-verticillate, shortly branched at the base, the primary shortly naked at the base, the secondary spiculate to the base. *Racemes* sub-erect, slender, usually 3-10 cm. long, dense flowered; pedicels and internodes about equal to the spikelets in length or shorter, sub-clavate at the tips; ferruginous hairs increasing in length from the base to the tip but even then not exceeding the spikelet in length. *Sessile spikelets* 4-5 mm. long, linear-oblong, brownish, ferruginous pubescent; lower glume chartaceous, narrowly truncate, 2-nerved, back flat, covered with short hairs, those on the margins the longer; upper truncate, 3-nerved, keeled, lower floret empty; lemma 2.5 mm. long, lanceolate, ciliate above; upper floret hermaphrodite; lemma 2 mm. long, linear-oblong, cleft at the apex, from which issues an awn 3-7 mm. long (awn often absent) rarely muticous; palea .5-1 mm. square, ciliate; anthers 2 mm. long.

Exceedingly common in the Khasi Hills, 3-4,000 ft. A gigantic specimen collected in Darrang in October 1937 was over 4.5 m. tall, with leaves up to 200 cm. long by 4 cm. wide.

5. *Erianthus hookeri* Hack., Mon. Androp. (1889) 142.

A perennial grass up to 2 m. tall. *Culms* stout, smooth and glabrous, villous below the panicle. *Leaves* rather flaccid, 30-50 cm. long, up to 2.5 cm. wide, median nerve strongly marked, white, smooth and glabrous on both surfaces or a few hairs at and above the insertion of the sheath, margins very rough; sheaths closely fitting, smooth and glabrous, villous at the top; ligules membranous, rounded, ciliate.

Inflorescence a silky panicle made up of silky racemes of spikelets; spikelets in pairs, one sessile the other pedicelled. Main axis of the inflorescence pubescent, pedicels and joints of the rhachis 3-4 mm. long, ciliate on the angles, callus long bearded. *Sessile spikelets* 5.5 mm. long, oblong, oblong-lanceolate in shape; lower glume chartaceous, 2-toothed at the apex, dorsally flat, 2-keeled, keels scabrid, villous with long hairs below the middle, 1-2-nerved between the keels, nerves often anastomosing; upper glume oblong,

chartaceous, 3-nerved, sparsely villous on the back, keeled, keel scabrid above the middle, margins broadly inflexed above, ciliate. *Lower floret* empty; lemma lanceolate, nerveless, ciliate, 4·4-2·5 mm. long, epaleate. *Upper floret* hermaphrodite; lemma 4 mm. long, oblong, hyaline, 2-lobed, margins ciliate, awned in the sinus; awn up to 2·5 cm. long, scaberulous, filiform; palea short, oblong, obtuse, hyaline, 1·75 mm. long. *Stamens* 3, anthers 2-2·5 mm. long.

Found in Therria forest on the Sylhet side of the Khasi Hills, 2,000 ft.

8. MICROSTEGIUM Nees.

Spikelets 2-nate, one sessile one pedicelled or both pedicelled, in fragile (easily disarticulating) sub-digitate or fascicled racemes, rarely villous. *Glumes* sub-equal, lower membranous or coriaceous, dorsally deeply channelled or concave, truncate or narrowly truncate or 2-toothed with margins narrowly inflexed throughout their length; the upper usually laterally compressed, keeled, acute. *Lower floret* empty or male; lemma hyaline or absent, ciliate, paleate or not, (when the lemma is absent the palea may be as long as the lower glume, male or neuter). *Upper floret* hermaphrodite; lemma usually very short, hyaline, entire, 2-fid or 2-auricled or reduced to the dilated base of the long awn; palea small or absent. *Lodicules* obliquely truncate. *Stamens* 3, rarely 2. *Caryopsis* firm.

Annuals or perennials, often decumbent below. *Leaves* conspicuously contracted at the base or petioled.

Key to the species of *Microstegium*.

Upper lemma well developed $\frac{1}{2}$ - $\frac{2}{3}$ length of upper glume; lobes long, acute; ligules 6-9 mm. long. I. *M. petiolare*.

Upper lemma very small, shortly 2-lobed :—

Anthers 3 :—

Anthers long, up to 1·5-3 mm. long :—

Lower floret absent; spikelets 2-2·5 mm. long. 2. *M. monanthum*.

Lower floret present, male or neuter :—

Hairs on the angle of the rhachis joints a little shorter than the joints; callus

- with dense hairs about $\frac{1}{2}$ the length of the spikelet; spikelets 3·5-4 mm. long, nodes pubescent. 3. *M. gratum*.
 Hairs on the angle of the rhachis $\frac{1}{2}$ - $\frac{2}{3}$ the length of the joint, sometimes absent at the top; callus hairs, short and sparse; spikelets 2·5-3·5 mm. long. 4. *M. ciliatum*.
 Anthers very small, spikelets 4·5-6 mm. long. 5. *M. vimineum*.
 Anthers 2; spikelets 3-4 mm. long; racemes rather distant, finally spreading; awn up to 15 mm. 6. *M. nudum*.

1. Microstegium petiolare (Hack.) Bor, Ind. Fer. Rec. 1, 3 (Botany) 1938, 87. Syn. *Ischænum petiolare* Hack., Mon. Androp. (1889) 238.

Culms 60 cm.-1 m. tall, stout, scrambling, rooting from the lower nodes, robust, terete, glabrous, simple or branched, pubescent below the panicle; nodes pubescent. *Leaf-blades* 20-30 cm. long, 2·2-2·5 mm. broad, rigid, spreading, lanceolate, setaceous-acuminate, both surfaces with appressed tubercle-based hairs; margins scabrid; sheaths terete, back and sides glabrous, rarely hairy; margins ciliate; ligules linear-oblong, 4-9 mm. long, truncate, fulvous in the middle, back often pubescent, decurrent into margins of sheaths.

Inflorescence of 8-20 racemes, forming an oblong-panicle, 6-10 cm. long, simple or divided; axis glabrous; axils bearded; joints and pedicels sub-trigonous, about as long as the spikelets, shortly ciliate. *Sessile spikelets* 4·5-5 mm. long, lanceolate-oblong; callus minutely or sparsely bearded; lower glume dorsally deeply channelled, chartaceous, 2 toothed; margins broadly inflexed from base to tip, 6-8-nerved; keels scabridly ciliate; upper glume chartaceous, keel scabrid, 3-nerved. *Lower floret* male; lemma 4·5-6 mm. long, oblong, membranous-hyaline, 3-nerved, the hyaline margins inflexed above and ciliate; palea equally long, hyaline acute; anthers 3 mm. long. *Upper floret* hermaphrodite; lemma 3·4-5 mm. long, ovate-oblong, membranous, hyaline, divided into 2-lobes to below the middle, lobes acute, glabrous, 3-nerved below, awned from the sinus; awn

4-8 mm. long; palea as long as the lemma, linear-lanceolate, acute, hyaline, nerveless, glabrous. *Pedicelled spikelets* rather shorter than the sessile, for the rest similar, except that the lower glume is not so deeply channelled.

Very common in the pine forests, Upper Shillong, where it grows in deep shade at 4-5,000 ft.

2. Microstegium monanthum A. Camus in Lecomte, Flor. Gen. de l'Indo-chine VII. 257. Syn. *Pollinia monantha* Nees apud Steud., Syn. Pl. Glum. (1854) 410.

An annual. *Culms* 30-90 cm. tall, decumbent at the base, afterwards erect, slender, multinoded, shortly exserted, puberulous below the inflorescence. Leaf-blades linear-lanceolate, base contracted, acuminate at the tip, flat, spreading, green, soft, 7.5-15 cm. long, 6-14 mm. broad, hairs appressed, at least below; margins very scabrid; sheaths sub-compressed, shorter than the internodes, puberulous or glabrous and hairy towards the throat; ligules short.

Inflorescence of 3-6 racemes, flexuous, 4-6 cm. long, hairy; joints of rhachis 2.2-4 mm. long, linear, compressed, sub-clavate, very slender, pale yellow or yellowish-brown, the angles furnished with fine hairs .5 mm. long; pedicel 1.8-2.2 mm. long, compressed, ciliate. *Sessile spikelets* oblong, 2-2.5 mm. long; callus shortly bearded; glumes spreading; lower 1.8-2.2 mm. long, oblong, obtuse, entire, sub-acute or narrowly truncate, channelled and scaberulous on the back, 2-keeled; keels scaberulous, or shortly ciliate at the tip; upper glume 2.2-5 mm. long, papyraceous, membranous, oblong-lanceolate, truncate, almost obtuse, mucronate or aristate, compressed laterally, navicular; keels scabrid above; margins white, scarious, velvety towards the apex, strongly 5-nerved. *Lower floret* absent. *Upper floret* hermaphrodite; lemma minute, 2 mm. long, rounded, 2-toothed; awn 5-6 mm. long, perfect, column glabrous, slightly exserted; palea very small, ovate, obtuse, nerveless, glabrous. *Stamens* 3; anthers linear, 1.5 mm. long. *Caryopsis* rounded. *Pedicelled spikelets* similar to the sessile but longer, ciliate.

KHASI and JAINTIA HILLS, NAGA HILLS, 4-5,000 ft.

3. **Microstegium gratum** A. Camus in Lecomte Flor. Gen. de l' Indo-Chine VII. 258. Syn. *Pollinia grata* Hack. Mon. Androp. (1839) 175.

Culms 30 cm.-1·5 m. slender, decumbent at the base, pubescent or scaberulous below the nodes. *Leaves* linear-lanceolate, acuminate, setaceous, tapering to the base. 10-20 cm. long by 8-20 mm. broad, rigid, scabrid on both surfaces; median nerve somewhat prominent; sheaths smooth and glabrous or with sparse tubercle-based hairs towards the base; ligules short, membranous, glabrous.

The *inflorescence* is a panicle made up of 6-12 racemes, slender, 6-10 cm. long, dense, greenish or purplish, shortly distant on the common axis, simple or rarely divided, spreading; rhachis of the racemes fragile, straight or slightly flexuous; joints 2·4-2·7 mm. long, linear, dilated at the top, sub-clavate, with hairs 2-2·5 mm. long; pedicels similar to the joint of the rhachis but shorter. *Spikelets* oblong, 3·5-4 mm. long; callus small, hairy, hairs about $\frac{1}{2}$ the length of the spikelet; lower glume papyraceous, ovate-oblong, obtuse, 2-toothed, flattened dorsally or obscurely channelled, glabrous save on the margins, 4-nerved, the intramarginal nerves interrupted towards the summit, rigid hairy on the upper part of the keels; upper glume 3·5-4 mm. long, membranous with hyaline margins, ovate-obtuse, sometimes mucronate, 3-5-nerved; the median above prominent; keel ciliate. *Lower floret* male or neuter; lemma 1·1-1·3 mm. long, hyaline, ovate-obtuse, nerveless. *Upper floret* hermaphrodite; lemma .5 mm. long, hyaline, 2-toothed; awn 6-15 mm. long; column chestnut, very glabrous; palea small or absent.

Plains and hills up to 4,000 ft., in wet and shady places.

4. **Microstegium ciliatum** A. Camus in Ann. Soc. Linn. Lyon, (1921) 201 and in Lecomte Flor. Gen. de l' Indo-Chine VII. 259. Syn. *Pollinia ciliata* Trin. in Mem. Ac. Petersb. Ser. 6. 2. (1833) 306.

Annual or perennial. *Culms* 60-120 cm. tall, very branched, decumbent at the base, then erect, nodes glabrous. *Leaf-blades* soft, thin, very variable, flat, spreading, linear-

lanceolate, narrowed at the base, finely acuminate, sessile or sometimes petioled, 4-10 cm. long, 5-12 mm. wide, glabrous below, with a few caducous tubercle-based hairs on the upper surface; margins scabrid; sheaths not auricled, rounded, very glabrous or puberulous at the nodes or with tubercled-based hairs on the margins; ligules short, membranous, glabrous.

Inflorescence a panicle made up of 2-10 false spikes, fasciculate, flexuous, 4-12 cm. long, fragile, pale-green, glabrescent, alternate or opposite on a common rhachis with the internodes 3-7 mm. apart; joints of the rhachis slender, linear, compressed, back obtusely carinate, shortly ciliate with short hairs; pedicels 1·2-2·5 mm. long, ciliate, hairs longer than those on the joints. *Sessile spikelet* 2·5-3·5 mm. long, linear-lanceolate or linear-oblong, narrow, pale; callus small, bearded. *Lower glume* papyraceous, linear-lanceolate or oblong-lanceolate, acute or sub-acute, entire or bimucronulate, margins strongly keeled, grooved on the dorsal surface; keels scabrous or pectinately ciliate; 2-4 intracarinal nerves present. *Upper glume* membranous, oblong or ovate-lanceolate, acute, aristulate or mucronulate; keel scabrous above. *Lower floret* neuter or male; lemma hyaline, narrowly oblanceolate, 1-nerved; *upper floret* hermaphrodite; lemma 5 mm. long, lanceolate or sub-orbicular, 2-toothed; awn 5-17 mm. long; palea small or absent. *Stamens* 3; anthers 1·5-2 mm. *Pedicelled spikelets* similar to the sessile; lower lemma absent.

Very common in the plains and up to 4,500 ft.

5. **Microstegium vimineum** A. Camus in Ann. Soc. Linn. Lyon (1921) 201, and in Lecomte, Flor. Gen. de l'Indo-Chine VII, 260. Syn. *Pollinia imberbis* Nees in Steud. Syn. Pl. Glumi. I (1854) 410.

An annual grass. *Culms* 80-100 cm. tall, decumbent at the base, then ascending, slender, very glabrous and with a deep channel in the stem. *Leaf-blades* linear-lanceolate, acuminate, base narrow, 4-8 cm. long, 6-12 mm. wide, flat, soft, spreading, often with a few deciduous hairs on the upper surface, margins very scabrous, median nerve prominent;

sheaths shorter than the internodes sub-compressed, striate, margins and throat often ciliate, nodes glabrous; ligules short, membranous.

Inflorescence made up of 2-6 false spikes (very rarely 1) 3-5 cm. long, spreading, erect, rather slender, pale-green, 6-10 mm. distant on the common rhachis, joints of the rhachis 3.5-4 mm. long, linear, slightly swollen at the top. *Sessile spikelets* 4.5-6 mm. long, lanceolate; callus obscurely bearded. *Lower glume* membranous, sub-acute, entire, 2-toothed, sub-truncate, channelled, but not much, with 2-4 intermarginal veins, 2-keeled at the top; keels scabrous or ciliolate; *upper glume* laterally compressed, boat-shaped, lanceolate acute, muticous, keel scabrous above, glabrescent or ciliolate, 1-3-nerved. *Lower floret* absent. *Upper floret* hermaphrodite, lemma minute, ovate lanceolate, without an awn or with one 9-11 mm. long; palea ovate, short. *Stamens* 3, anthers 3-5 mm. long, small, didynamous, oblong, not exserted at anthesis, adhering to the fruit. *Caryopsis* rounded. *Pedicelled spikelets* rather similar to the sessile.

KHASI and Jaintia Hills, NAGA HILLS, 4-5,000 ft.

6. Microstegium nudum A. Camus in Lecomte, Flor. Gen. de l'Indo-Chine VII. 261. Syn. *Pollinia nuda* Trin. in Mem. Acad. Petersb. ser. 2. (1833) 307.

A very slender annual grass. *Culms* 60-90 cm. long, decumbent, rooting at the base, with divergent branches, multinoded, channelled on one side, very glabrous. *Leaf-blades* lanceolate-acuminate, base narrow, flat, soft, spreading, 2.5-10 cm. long, 5-8 mm. wide, glabrous or with a few sparse hairs above and below with tubercle bases, median nerve small, margins hardly thickened, minutely scabrid; sheaths narrow, rounded, striate, hairy, the upper shorter than the internodes; ligules short, glabrous.

Inflorescence made up of 3-6 false spikes, 4.5-10 cm. long, narrow, soft, at length widely spreading, green, flexuous, glabrescent; joints slender, filiform rounded, longer or shorter than the spikelets; inner face grooved, the outer

convex or obtusely keeled, glabrous or with acute edges, ciliolate at the base, sessile. *Spikelets* narrowly lanceolate, 3-4 mm. long, sometimes distant; callus nearly naked, obtuse, small, shortly bearded. *Lower glume* membranous, very narrow, rarely truncate or obtuse, often strongly divided; back concave, 2-keeled; keels scaberulous or ciliate; upper glume lanceolate, laterally compressed, navicular, acuminate or mucronulate; keel obtuse, scabrous; margins hyaline above, ciliate, rest very glabrous or almost, nerveless or 3-nerved, lateral nerves anastomosing. *Lower floret* barren; lemma 3-4 mm. long, linear, obtuse, glabrous or almost so, nerveless; palea absent. *Upper floret* hermaphrodite; lemma of varying length, at least 1.5-2 mm. long, linear, acute or lanceolate, 3-nerved; awn 15-18 mm. long, imperfect, capillary, very flexuous, scabrous; palea small or absent, truncate. *Stamens* 2; anthers linear-oblong, 1 mm. long. *Caryopsis* rounded, sub-ovoid, abruptly narrowed at the top. *Pedicelled spikelets* very similar to the sessile. The racemes are rather distant on the common axis and are finally spreading (divariccate). The lower glume is shallowly concave with 2 carinal and 2 other nerves within close to the carinals.

NAGA and KHASI and JAINTIA HILLS, 5,000 ft.

9. EULALIOPSIS Honda.

Spikelets binate, sessile and pedicelled, similar, seated on the articulate, fragile, compressed, slender rhachis of digitate or fascicled false spikes; fascicles with filiform peduncles on a more or less branched panicle. *Callus* densely clothed with long brown hairs. *Lower glume* flattened, 2-3-dentate, dorsally hairy at the base, 5-7-nerved, margins inflexed; upper glume cymbiform, minutely cuspidate, 3-5-nerved, with a slender awn. *Lower floret* male or barren; lemma hyaline, sparsely ciliate, elliptic; palea finely ciliate. *Upper floret*; lemma narrow, conduplicate, entire or 2-toothed, shortly awned from the tip or minute sinus; palea broad and nearly as long as the glume, densely ciliate on top.

Densely tufted perennials with a woolly rootstock and

basal sheaths. Leaves convolute when old, wiry; mouth of sheath ciliate.

Eulaliopsis binata (Retz.) C.E. Hubbard in Hook. Ic. Pl. sub tab. 3262. 1935. Syn. *Ischaemum angustifolium* Hack., Mon. Androp. (1839) 241.

A perennial, caespitose grass. Culms 69-90 cm. tall, erect, slender, 3-4-noded, somewhat compressed, channelled along one side, very glabrous, sending out flower-bearing branches at the upper 2 or 3 nodes, often solitary, very tomentose at the base. Leaf-blades hardly distinct from the sheath, linear, flat. 30-60 cm. long, 2-3 mm. broad, or rolled when dry, rigid, almost erect; the base fimbriate; margins scabrous; lower sheaths crowded, dilated at the base, covered with a dense white tomentum, persistent, surrounding the base of the culms, the upper rounded, striate, shorter than the internodes; nodes hairy or glabrous; ligule a ridge of short hairs.

Spiciform racemes 2-4, lateral, sessile, unequal, 2-4 cm. long, somewhat thick, dense; pubescence golden or dark yellow; common axis glabrous; joints of rhachis and pedicels 2-angled, 1·75-2·25 mm. long, linear, filiform; disarticulation almost oblique; hairs at the base as long as the joint, the remainder laxly and shortly ciliate. Spikelets 3·5-4·5 mm. long, lanceolate; callus very short obtuse, with rusty hairs, $\frac{1}{4}$ - $\frac{1}{2}$ the length of the spikelet. Lower glume 3-4 mm. long, sub-papyraceous, obtuse or acute, 2-3-toothed, margins not hyaline, not inflexed, back convex, without a groove, definitely 5-nerved, densely ciliate towards the base and on the margins with hairs equal to the glume in length, tufts of hair on the back, scabrid at the apex; upper glume 3·5-4·5 mm. long, membranous, papyraceous, lanceolate, obtuse, 2-toothed and mucronate, or with an awn 1-2·5 mm. long, rigid, scabrid; keel scabrid at the apex, bearded at the base, 3-5-nerved. Lower floret male; lemma hyaline, oblong-obtuse, 2-toothed, nerveless, glabrous or ciliolate at the top; palea shorter, linear, 2-toothed, ciliolate, obscurely 2-nerved; anthers 2 mm. long; very rarely the palea and stamens absent. Upper floret hermaphrodite; lemma 3·4-4·3 mm. long,

hyaline, linear, 1-nerved, glabrous, 2-toothed; awn imperfect, 6-9 mm. long, issuing from the slit; palea 2·5-3 mm. long, broadly ovate, very obtuse, entire or toothed, hyaline, nerveless; top fimbriate.

Collected in Assam for the first time in 1935 in the Naga Hills at 4,000 ft. It also is to be found in the foothills of the Assam Valley, but it is not at all common.

10. EULALIA Kunth.

Spikelets all alike or nearly so, 2-nate, one sessile, the other pedicelled, on the articulate, fragile rhachis of 2-nate, digitate or fascicled, spike-like racemes, the pedicelled falling from their pedicels, the sessile deciduous together with the contiguous joint of the rhachis and the pedicel. *Florets* typically 2; lower reduced to an empty lemma or represented by a minute scale or quite suppressed; upper always hermaphrodite. *Glumes* equal, rigidly membranous to coriaceous; lower dorsally flattened or shallowly concave (not grooved), more or less 2-keeled with inflexed margins; upper 1-3-nerved, keeled. *Lemmas* hyaline; lower muticous, sometimes much reduced or quite suppressed; upper very short, 2-lobed, awned. *Paleas* small or 0. *Lodicules* 2, small, cuneate. *Stamens* 3. *Stigmas* linear, laterally exserted. *Grain* oblong; embryo almost half the length of the grain or longer; hilum basal, punctiform.

Perennials. *Culms* simple, erect or ascending. *Leaf-blades* convolute in bud, then flat, usually narrow, gradually passing into the sheath; racemes usually coloured brown or purplish or silver.

Key to the species of *Eulalia* (after A. Camus).

Joints of the rhachis and spikelets with whitish, greyish or mauve hairs :—

Upper lemma minutely 2-toothed. 1. *E. fastigiata*.

Upper lemma deeply bifid :—

Upper glume awnless :—

Lower glume with 2-marginal, 2-intramarginal nerves (at least in pedicelled spikelets) :—

Nerves anastomosing below the tip, basal sheaths bare. 2. *E. quadrinervis*.

- Nerves not anastomosing, basal sheaths very tomentose. 3. *E. speciosa.*
- Lower glume with carinal nerves only, even in the pedicelled spikelets. 4. *E. tristachya.*
- Upper glume awned. 5. *E. pallens.*
- Joints of the rhachis and spikelets with golden, yellow or fulvous hairs, very rarely pale yellow :—
- Lower lemma present; lower sheaths densely silky or tomentose :—
- Tomentum on base dark brown. 6. *E. phæothrix.*
- Lower sheaths densely white villous. 7. *E. velutina.*
- Lower lemma absent, lower sheaths scarcely hairy. 8. *E. cummingii.*

Alternative key to the species of Eulalia.

- Upper lemma minutely 2-toothed. 1. *E. fastigiata.*
- Upper lemma deeply divided :—
- Upper and lower glumes sub-equal, lower lemma present :—
- Upper glume of sessile spikelet awned or mucronate, or at least the median nerve continued into the hyaline tissue, spikelets 3-4 mm. long. 5. *E. pallens.*
- Upper glume of sessile spikelet not awned or mucronate :—
- Basal sheaths naked :—
- Spikelets 5-6 mm. long. 2. *E. quadrinervis.*
- Spikelets 2-5-3-5 mm. long; hairs silvery. 4. *E. tristachya.*
- Basal sheaths woolly :—
- Hairs on joints of rhachis whitish, basal sheaths very tomentose, golden brown; leaves hairy. 3. *E. speciosa.*
- Hairs on rhachis-joints golden; basal sheaths with dark reddish brown tomentum. 6. *E. phæothrix.*
- Basal sheaths with whitish villæ; leaves glabrous. 7. *E. velutina.*
- Upper and lower glumes unequal; lower lemma absent. 8. *E. cummingii.*

1. Eulalia fastigiata Stapf ex Haines, Bot. B. & O. p. 1014. Syn. Erianthus fastigiatus Nees ex Steud., Syn. Pl. Glum. (1854) 409.

Culms 1-1.5 m. tall, rather robust, glabrous, but with appressed pubescence below the panicle. *Leaves* rigid, erect,

glaucous, flat, linear-acuminate, the narrow base hardly distinct from the sheath, 30-60 cm. long, 5-7 mm. wide, glabrous, somewhat scabrid below; margins very scabrid; median nerve thick; sheaths fimbriate at the throat, the upper shorter than the nodes; ligule very short, membranous, truncate, ciliolate.

Inflorescence an ovate oblong panicle; common axis about as long as the lower branches; branches 10 cm. long; nodes numerous, simple, or the lower branched; racemes sessile, the upper shorter, spreading, erect, rather slender, coloured mauve or black-violet, densely covered with long, silky-white hairs; pedicels and joints filiform, scarcely dilated, articulate, sub-oblique at the top; back obtusely keeled, glabrous, angles ciliate with soft white hairs. *Spikelets* linear-lanceolate, 4-5 mm. long, brownish or reddish black, rather paler at the summit; callus hairs shorter than the spikelets. *Lower glume* 4-5 mm. long, papyraceous, acuminate, sub-2-toothed, keel aculeate at the top, covered at the base and sides with hairs 4·5-5·5 mm. long, slightly depressed on the back, distinctly 3-nerved or nerveless apart from the side nerves, scaberulous; upper glume papyraceous, lanceolate, acute or acuminate, keel scaberulous, 1-nerved, margins hyaline, long ciliate at the top. *Lower floret* empty; lemma 3·5-4·5 mm. long, lanceolate, linear, obtuse or subacute, base membranous, coloured, hyaline at the top, ciliate or not. *Upper floret* hermaphrodite; lemma 2·2·5 mm. long, hyaline, oblong, carrying an awn below the 2-toothed summit; teeth rounded; lobes short ciliate; awn scaberulous 1·25 cm. long; base 3-nerved, palea broadly oblong, very short; apex rounded, long ciliate. Ovary minute; styles slender, free to the base. *Stamens* 3; anthers 2·2·5 mm. long, golden yellow, linear.

A common grass up to 4,000 ft.

2. **Eulalia quadrinervis** (Hack.) O. Kuntze, Rev. Gen. Pl. II (1891) 775. Syn. *Pollinia quadrinervis* Hack., Mon. Androp. (1889) 158.

Perennial. *Culms* 60 cm.-1 m. tall, tufted, slender, rounded, very glabrous, or pubescent at the top. *Leaves*

sub-rigid, spreading, linear, acuminate, glabrous, or hairy below, glaucous below, green and scaberulous above; margins scabrid, 10-20 cm. long, 4-7 mm. broad; sheaths very glabrous or covered with tubercle-based hairs, the upper shorter than the internodes, the lower longer; ligules hairy.

False spikes 3-6, 7-15 cm. long, with golden-brown or mauve hairs; articulations of the rhachis and pedicels 2.5-3 mm. long, hairs stiff and spreading, white or mauve; joints of the rhachis rather oblique; joints only swollen at the tip. *Spikelets* oblong-lanceolate, sub-acute, 5-6 mm. long, pale-brown, callus hairs long, white. *Lower glume* 5-6 mm. coriaceous, papyraceous, hyaline at the apex, ovate-lanceolate, obscurely truncate, margins inturned, back depressed, scabrous, keels hispid above, base with long, soft, white or mauve hairs, 4-nerved; nerves anastomosing below the tip; upper glume 5-6 mm. long, papyraceous, hyaline at the top, smooth shining, lanceolate, acute, slightly apiculate, keel glabrous, obscurely 3-nerved. *Lower floret* empty; lemma 4.5-5.5 mm. long, hyaline, oblong-lanceolate, acute, 2-nerved, ciliate. *Upper floret* hermaphrodite; lemma 2.5-3 mm. long, broadly cuneiform, oblong, hyaline, ciliate towards the top, bilobed near the base, lobes acute, awn 17-20 mm. (in pedicelled spikelets 14 mm.) long, palea oblong, short; lodicules shortly hairy. *Stamens* 3; anthers 3.5 mm. long. *Stigmas* lanceolate, purplish, blunt, 2.5-3 mm. long, a little longer than the style.

Very common in the KHASI HILLS about 4,000 ft.; specimens have been found in the plains below Cherrapunji.

3. Eulalia speciosa (Hack.) O. Kuntze, Rev. Gen. Pl. II. (1891) 776. Syn. *Pollinia speciosa* Hack., Mon. Androp. (1889) 159.

Perennial. *Culms* 80 cm.-1.2 m. tall, slender, firm, many noded, smooth, pubescent below the inflorescence. *Leaf-blades* linear, acuminate, setaceous, 30-50 cm. long, 4-7 mm. broad, flat, rigid, erect, very glabrous or hairy, (densely tomentose in Khasi specimens) glaucous above, margins scarcely scabrid, median nerve slender; sheaths rounded, narrow, very glabrous or pubescent at the top and about the

nodes; ligules very short, truncate, reddish, membranous, glabrous or ciliolate.

Inflorescence formed of 4-8 spiculate branches, 7-20 cm. long, spreading, erect, sometimes branched at the base; hairs greyish or reddish. Common axis ciliate, nodes 3-5 mm. apart, alternate; joints and pedicels scarcely longer than 2·5-2·75 mm., linear, sub-dilated, trigonous, ciliate on the angles; hairs rigid, white or grey. *Spikelets* oblong, 5·5-5· mm. long, reddish below the middle, paler above and with green margins; callus ·8 mm. long; callus hairs 1-1·2 mm. long. *Lower glume* papyraceous, truncate, emarginate, margins inturned, ciliate with white, spreading hairs; back almost depressed, densely hairy in the lower part; apex scabrous, nerveless apart from the carinals; upper glume broadly oblong, narrowly truncate, margins inturned, hyaline, ciliate; keel glabrous, slightly pubescent towards the tip, elsewhere smooth and shining. *Lower floret* empty; lemma 3·5-5 mm. long, broadly oblong, obtuse, base membranous and coloured, top hyaline, margins infolded, ciliate. *Upper floret* hermaphrodite; lemma 3·75-4 mm. long, narrowly 2-fid; lobes acute, eciliate, awn tortuous and twisted, 16-20 mm. long; palea very short, ovate, ciliolate; lodicules glabrous. *Pedicelled spikelets* have the lower glume 3-nerved, i.e., 2 carinals and 1 in the centre. Anthers 2·5 mm. long. The basal sheaths are not always woolly especially in young specimens, very woolly with golden wool in old specimens.

A common hill grass. 4-7,000 ft.

4. **Eulalia tristachya** O. Kuntze, Rev. Gen. Pl. II. (1891) 775. Syn. *Pollinia argentea* Trin. in Bull. Soc. Ac. Petersb. I. (1836) 71.

Perennial. *Culms* ·3-1·2 m. erect, tufted, dense, somewhat robust, rounded, smooth, simple or branched, shortly exserted at the top, very glabrous. *Leaf-blades* rather rigid and erect, linear, acuminate, setaceous, not contracted at the base, 10-45 cm. long, 1·5-6 mm. broad, green, very glabrous or with appressed pubescence near the top and on the margins; ligule very short, ·3 mm. long, truncate, bearded.

Inflorescence a panicle of 2-12 false spikes slender, 4-15 cm. long, carrying distant spikelets; rhachis firm, filiform, compressed; joints and pedicels 1.7-3 mm. linear, filiform, trigonous; hairs white, long. *Spikelets* oblong, 2.5-3 mm. long or somewhat longer (pedicelled shorter) callus .6 mm. long, obtuse; *lower glume* 2.5-3 mm., papyraceous and hard at the base, membranous hyaline at the top, linear-oblong, depressed on the back, pale brown below the middle, pale yellow above, narrowly truncate, no central nerve; apex entire or keel nerves excurrent and 2-mucronate, margins inturned, stiff ciliate above, elsewhere hairs soft, white, erect. *Upper glume* 2.5-3 mm. long, hyaline and emarginate at the top, broadly oblong, obtusely carinate, 1-nerved, margins similar to those of lower glume but shortly ciliate. *Lower floret* empty; lemma 2-3 mm. long, hyaline, whitish, linear, oblong, obtuse, nerveless, ciliate; base coloured. *Upper floret* hemaphrodite; lemma 1.25-2.25 mm. long, small, very narrow, linear-oblong, divided into two subulate lobes; awn slender, 10-20 mm. long; palea absent. *Lodicules* small, wedge-shaped. *Anthers* 2.5 mm. long. *Pedicelled* spikelets similar to the sessile but narrower.

Very common in the KHASI and JAINTIA HILLS, 4-5,000 ft.

5. Eulalia pallens (Hack.) O. Kuntze, Rev. Gen. Pl. II (1891) 775. *Syn. Pollinia pallens* Hack., Mon. Androp. (1889) 156.

Perennial. *Culms* 60-90 cm. tall, erect, slender, glabrous and smooth; base naked, clothed with the sheaths of old leaves, glabrous; roots fibrous. *Leaf-blades* narrow, linear, 15-25 cm. long, 1.2-2.5 mm. wide, tapering from a base which is not distinct from the sheath, to a filiform tip, glabrous beneath, hairy on the upper surface; margins scaberulous and revolute; sheaths rather smooth and glabrous; ligule very short, membranous, minutely ciliate.

Racemes about 5, 5-10 cm. long, slender, silky hairy. *Spikelets* narrowly lanceolate, about 3 min. (up to 4 mm.) long, often purple or yellow. *Lower glume* narrow, membranous, bicuspidate, shortly villous, 2-nerved; upper glume lanceolate, laxly villous, 1-nerved, the nerve being

continued out to the edge of the hyaline margin or produced into a short awl; keels and margins ciliate. *Lower floret* empty; lemma oblong, obtuse, ciliate, 2·5-3 mm. long; *upper floret* hermaphrodite; lemma oblanceolate, 2·2·5 mm., ciliate, narrow, 2-fid, awn 2-3 times as long as the spikelet, adnate portion of awn forked about half way down; palea broadly ovate or orbicular, entire, hyaline, ciliate, 2 mm. long; anthers 3 purple, linear, 2·2·5 mm. long.

Myntlah. 2,500 ft. in swamps. In a specimen collected here the racemes are yellow; stigmas yellow; anthers purple. Also occurs in the Naga Hills 5,000 ft.

6. Eulalia phæothrix (Hack.) O. Kuntze, Rev. Gen. Pl. II. (1891) 775. Syn. *Pollinia phæothrix* Hack., Mon. Androp. (1889) 168.

Perennial. *Culms* 2 m. and more, erect, robust or slender, rounded, 3-4 noded, shortly bare at the top, hairy below the inflorescence, and on the upper nodes; the base is covered with a dense, brownish-red tomentum. *Leaf-blades* erect, spreading, linear, acute, hardly distinct from the sheath, rigid, often convolute, glabrous or with a few hairs on the lower surface, scabrid above and on the margins, 15-30 cm. long by 1·5-9 mm. broad, basal sheaths woolly, (hairs crisp, red brown), the upper shorter than the internodes, not auricled, often pubescent towards the summit, the upper sometimes spathiform; ligules very short, membranous, ciliolate.

Inflorescence a panicle made up of 2-6 false spikes, 5-20 cm. long, simple, erect, spreading, flexuous, silky hairy, shining, light brown or dark brown, fawn or golden; rhachis compressed, plano-convex, fragile; joints with an auricled appendage; joints and pedicels densely hairy with brownish or whitish hairs. *Spikelets* linear oblong, 4-5 mm. long, callus very short, hairy. *Lower glume* papyraceous, oblong or linear-oblong, truncate, margins incurved, nerveless or 2-nerved, back flat with, especially towards the margins, stiff hairs, golden or reddish in colour, almost glabrous at the top; upper glume papyraceous, ovate-oblong, summit narrowly truncate, obscurely keeled, with long hairs towards the

middle and at the base, shortly pubescent at the tip, not aristate, 1-nerved; margins hyaline and ciliolate. *Lower floret* empty; lemma 4.5 mm. long, base coloured, oblong or ovate-oblong, obtuse, nerveless, ciliate above the middle. *Upper floret* hermaphrodite; lemma 1.3-1.6 mm., linear-oblong, opaque in the middle, hyaline towards the margins, deeply bifid; segments narrow, linear, rather sharp, ciliate; awn 10-12 mm. flexuous, very glabrous; palea obovate, truncate, fimbriate at the top, often scarcely shorter than the lemma. *Anthers* 2.2-2.5 mm. long. *Pedicelled spikelet* smaller and narrower than the sessile.

Common in the KHASI and JAINTIA HILLS.

7. Eulalia velutina (Hack.) O. Kuntze, Rev. Gen. Pl. II (1891) 775. Syn. *Pollinia velutina* Hack., Mon. Androp. (1889) 169.

Perennial. *Culms* 0.8-1 m. erect, rounded, silkily pubescent below the inflorescence, often somewhat rose coloured. *Leaf-blades* linear; base narrow, shortly acuminate, erect, 20-30 cm. long, 5-6 mm. broad, very glabrous, margins smooth; sheaths very glabrous even on the nodes, the lower white velvety, the upper spathiform at first; ligules 1 mm., truncate, reddish, membranous.

Inflorescence an erect or drooping panicle of 5-6 false spikes, sometimes more, 7-10 cm. long; rhachis extremely fragile, thick; articulations oblique, strongly auricled, appendaged, joints and pedicels 3-5 mm. long, densely covered with rigid golden hairs (1.75-2 mm. long). *Spikelets* 5.5 m. long, covered with fulvous golden hairs; callus shortly bearded. *Lower glume* papyraceous, contracted at the middle, very narrowly truncate, slightly bimucronate, margins laxly inflexed, back flat or slightly concave, covered entirely with fulvous hairs which are rigid and very dense, 2-nerved; upper glume papyraceous, lanceolate, suddenly very acute, 1-nerved, keeled, shortly hairy along the keel; the remainder of the back shining. *Lower floret* empty; lemma 2.5 mm. long, lanceolate, acute, 2-nerved. *Upper floret* hermaphrodite; lemma 4.5 mm. long, hyaline, glabrous, shortly obtuse and 2-toothed at the apex, 3-nerved at the base; awn 10-11 mm.

long; palea 1-1·25 mm., obovate, truncate, ciliolate; anthers 3 mm. long.

KHASI and JAITIA HILLS. 4-5,000 ft.

3. Eulalia cummingii A. Camus in Lecomte, Flor. Gen. de l'Indo-Chine VII, 250. Syn. *Pollinia cummingii* Nees in Hook., Kew Journal II (1850) 98.

Perennial. *Culms* low, slender, ascending, 25-60 cm. long, pubescent, yellowish at the top, 5-6 noded. *Leaf-blades* flat, spreading, rather rigid, linear, acuminate, abruptly contracted at the base, 5-20 cm. long, 3-5 mm. wide, green, very glabrous below, sparingly scabrid above and on the margins, rarely with scattered hairs; upper sheaths very glabrous, narrow, rounded or those of the innovations sub-compressed, the lower densely crowded, the lowest scale-like; ligule very short, .5 mm., truncate, membranous, coloured, glabrous or ciliate.

Inflorescence of 2-4 false spikes, 4-9 cm. long, common axis hairy; joints of the rhachis and the pedicels 2·2-2·5 mm. long, linear, backs and sides covered with dense golden brown hairs. *Spikelets* oblong, 4 mm. long, callus short obtuse, hairs 1·3-1·7 mm. long. *Lower glume* 2-nerved, membranous, papyraceous, narrowly truncate, ciliate at the top; margins inflexed below the summit, involute at the base; back flat, densely tomentose below the middle; pubescence appressed, golden brown, exceeding the top of the glume. *Upper glume* papyraceous, membranous, oblong, truncate, keeled, laxly hairy above the middle, ciliate at the summit, 1-nerved. *Lower floret* absent. *Upper floret* hermaphrodite; lemma 6-8 mm. broader than long, rather thick, sub-3-nerved at the base, divided at the top into two lobes which are short, acute, ciliolate or almost glabrous; awn 1·2-1·5 mm. long, slender. *Anthers* 2·5 mm. long. *Ovary*: style and stigmas almost equal 2·5 mm. long.

Khasi and Jaintia Hills, 4,000 ft.

11. PSEUDOPOGONATHERUM A. Camus.

Inflorescence in spiciform racemes, often numerous, sometimes branching at the base, close on a glabrous common

axis, sub-sessile; pedicels glabrous; spikelets very small, 2-nate, often all pedicelled and falling from the pedicel at maturity; the rhachis not breaking up easily; more rarely one pedicelled and the other sessile and remaining attached to the pedicel and the adjoining joint. *Lower glume* rounded on the back or almost so; margins involute or inflexed. *Upper glume* obtuse, glabrous often aristate or mucronate. *Lower floret* barren; lemma membranous, ovate-obtuse. *Upper floret* hermaphrodite; lemma stipitate, rarely linear and extremely narrow; awns often long, ciliate.

Annuals with the habit of *Pogonatherum*; culms slender, very glabrous; leaves narrowly linear or setaceous at the tip, rolled when dry, somewhat rigid.

Pseudopogonatherum contorum A. Camus in Lecomte, Flor. Gen. de l'Indo-Chine, VII, 255. Syn. *Pollinia articulata* Trin. in Bull. Soc. Acad. Petersb. I (1836) 71.

Annual. *Culms* 20-50 cm. tall, very slender, densely tufted, erect, rounded, very glabrous, internodes short, shortly exserted at the top. *Leaves* erect, flexuous, filiform or narrowly linear, acuminate, more or less scabrous, sub-dilated at the base, sometimes hairy, 10-30 cm. long, 1.5 mm. broad; median nerve prominent below, showing as a white line above; sheaths rounded, narrow, glabrous, even at the base of the culms, where they are not crowded; ligules very shortly ciliate.

Inflorescence a dense panicle, the common axis carrying 3-20 close racemes, alternate or opposite, rarely 4-nate, silky-white, sub-erect, simple or divided at the base, 4-6 cm. long; rhachis tardily breaking up, back very glabrous; margins with hairs which become longer at the summit; joints equal in length to the pedicel. *Spikelets* all pedicelled, lanceolate, 1.5-2.5 mm. long; callus obtuse, .4 mm. long, with white hairs .4-.8 mm. long. *Lower glume* papyraceous, membranous at the summit, shining, obtuse or somewhat truncate, with 2 sharp teeth, margins narrowly inflexed, slightly depressed between the keels, which are covered in the upper portion with hairs which are almost erect, nerveless apart from the keel nerves; upper glume papyraceous,

ovate-lanceolate, obtuse, keeled, 1-nerved; margins glabrous, or puberulous close to the keel, awn 7-15 mm. long. *Lower floret* barren; lemma .75-1.25 mm. long; ovate-obtuse, nerveless, glabrous. *Upper floret* hermaphrodite; lemma membranous, linear, 1-nerved, glabrous, almost entire, bifid or 2-toothed; awn robust, up to 3 cm. long, ciliate below; palea absent. *Lodicules* 2. *Stamens* 3; anthers .5-.7 mm. long. *Stigmas* short.

KHASI and JAINTIA HILLS 4-6,000 ft.

12. POGONATHERUM P. Beauv.

Inflorescence a solitary raceme at the summit of the stem and of its branches. *Spikelets* imbricate, 2-nate at each node of the rhachis, the pedicelled female, rounded, articulated on the pedicel, the sessile hermaphrodite, falling together with the contiguous joint of the rhachis, both 1-2-flowered, long awned; glumes membranous, the lower muticous, truncate or rounded at the apex, without a keel; the upper of the same length or longer, keeled, acute or 2-toothed, awn imperfect, slender. *Lower floret*; lemma hyaline and empty or sometimes absent and the palea persisting; the floret is male, with 2 stamens or more rarely hermaphrodite. *Upper floret* hermaphrodite; lemma narrow, dentate or 2-fid, hyaline, awned; the awn arising from the sinus, capillary, perfect or almost so, long; palea equalling the lemma in length or shorter, hyaline, nerveless. *Lodicules* absent. *Stamens* 1-2; anthers linear-oblong. *Style* capillary; *stigmas* linear-oblong, exserted from the top of the spikelet. *Caryopsis* obovate, slightly laterally compressed, back more convex than the ventral face; embryo 2/3 the length of the caryopsis.

Usually perennials, densely caespitose. *Culms* slender branched. *Leaves* linear or linear-lanceolate, acuminate.

Blatter and McCann in Bombay Grasses, 1935, state that the pedicelled spikelet is male or neuter; actually it is usually female, occasionally male or empty, in Assam specimens.

Key to the species of *Pogonatherum*.

- Spikelets 4 mm. long, or over 1. *P. rufobarbatum*
 Spikelets less than 4 mm. long :—
 Lower floret present; sessile spikelets 2·5-3
 mm. long; callus hairs 1·1-1·5 mm.; glumes
 sub-equal; awn 15-18 mm.; hermaphrodite
 flowers with 2 stamens, rarely 1. 2. *P. paniceum*.
 Lower floret absent; sessile spikelets 2 mm.
 long, callus hairs 2 mm. long; upper glume
 longer than the lower; awn 18-22 mm.; her-
 maphrodite flowers with 1 stamen, rarely 2. 3. *P. crinitum*.

1. *Pogonatherum rufobarbatum* Griff. Notul. III
 (1851) 81.

Perennial. Culms 25-60 cm. tall, densely tufted, terete, smooth and shining, glabrous, wiry. Leaf-blades lanceolate, tapering to a fine point and also to the sheath, 5-10 cm. long, up to 6 mm. broad, many-nerved, median nerve prominent below, smooth and glabrous, margins imperfectly thickened, smooth; sheaths rather loose, smooth and glabrous, auricled; ligules convex upwards, 1 mm. long, membranous, continuous with the auricles of the sheath.

The inflorescence consists of a false spike or raceme, 2·5-6 cm. long, up to 4 mm. broad; rhachis rather stout, angled; ciliate on the angles, joints 2/3 the length of the spikelets about 2·5 mm. long; pedicels similar (2 mm.), but rather more slender. Spikelets oblong, always 2-flowered, callus small, callus hairs shorter than the spikelet. Sessile spikelet; lower glume 3·25 mm. long, oblong, two-lobed or auricled at the top, ciliate along the hyaline margins at the top, obscurely 3-5 or even 7-nerved; upper glume 3-3·5 mm. long, oblong, shortly two-lobed, median nerve prominent and carried upwards between the lobes into an awn 15-20 mm. long, keeled, scaberulous or hairy above, keel scaberulous ciliate on the lobes. Lower floret male; lemma 3·2-5 mm. long, lanceolate, acute, hyaline, glabrous, nerveless; palea as long or smaller, broadly oblong, obtuse, glabrous. Stamens 2, anthers 2·5 mm. long. Upper floret herma-phrodite; lemma 3 mm. long, lanceolate, hyaline, lobed for $\frac{1}{2}$ - $\frac{1}{3}$ its length, glabrous; awn 17-20 mm. long, column

brownish and ciliate (hirsute). *Palea* hardly shorter than the lemma. The anthers in this floret are 3 mm. long.

Pedicelled spikelets linear-oblong, 3 mm. long, the callus hairs almost equaling the spikelet; lower glume 2-nerved, pilose on the back, lower lemma absent, upper lemma similar to that of the sessile spikelets, containing a female floret.

Growing on rocks in streams in the Khasi Hills where it is continually washed by spray. Quite different in appearance from *P. panicum* and a good species.

2. *Pogonatherum panicum* Hack. in All. Bot. Zeit. XII. 178. Syn. *Pogonatherum saccharoideum* Beauv., Agrost. 176, t. 11, fig. 7.

A caespitose perennial. *Culms* 10-50 cm. tall, in dense tufts; nodes numerous, shining; primary branches solitary and rarely simple; branchlets filiform, very glabrous. *Leaf-blades* soft, spreading, pale green, linear or linear-lanceolate, acuminate, base rounded, abruptly contracted, the older leaves flat, those at the top shorter, 2-7 cm. long, 1-4 mm. wide, tubercular, scabrid or scaberulous; sheaths lax, sub-compressed, smooth; throat fimbriate; ligules reduced.

Inflorescence consisting of a terminal raceme or false spike, 1.5-3 cm. long; joints and pedicels 1.1-1.5 mm. long, linear-filiform, somewhat dilated at the top, depressed-trigonal, margins with white hairs up to 3 times as long as the joints. *Sessile spikelets* linear-oblong, fulvous, 2.5-3 mm. long; callus small, with a few white hairs. *Lower glume* 2-3 mm. long, membranous or almost papyraceous at the base, broadly linear-oblong, often a little truncate at the top, back convex, 2-3-nerved, scaberulous, often glabrous and ciliate below the apex, sometimes hispid. *Upper glume* 2.5-3 mm. long, membranous, broadly lanceolate, obtuse, keels hispid or scabrid, very hairy at the apex, awn 12-14 mm. long, slender. *Lower floret* male with 2 stamens, rarely hermaphrodite; lemma hyaline, oblong-ovate, nerveless, ciliate at the top, 1.5-2.5 mm. long; palea linear-oblong, 2-toothed, rarely absent. *Upper floret* hermaphrodite; lemma 1.5-2.5 mm., hyaline, narrow, linear or linear-oblong, almost

keeled, toothed, hyaline, glabrous, nerveless. *Stamens* 2, very rarely 1.

Pedicelled spikelet usually smaller than the sessile, rounded; lower floret absent. *Upper floret* female or very rarely male or neuter.

Very common in shady places up to 5,000 ft.

3. Pogonatherum crinitum Kunth, Enum. I. (1833) 478.

Close to *P. paniceum* Hack. for which it is often mistaken. It is however more slender, the *sessile spikelets* are at most 2 mm. long, more truncate and broader above; upper glume is longer than the lower, glabrous or shortly ciliate, and less obtuse; lower floret absent; in the upper floret the lemma is more toothed, the awn is 18-22 mm. long, the palea is 2/3 the length of the lemma. *Stamens* often 1 rarely 2.

Found in similar situations to the last named species.

13. APOCOPIS Nees.

Racemes spiciform, 2-nate, or sub-digitate, closely crowded and resembling a single raceme or spike; rhachis with a ring of hairs at the nodes, margins ciliate, joints numerous, fragile, linear, back convex or sub-keeled, ventral face flat. *Spikelets* narrowly imbricate, 2-nate, one reduced to a short pedicel situated on a very reduced callus, the other sessile, well-developed, dilated and truncate at the top, dorsally sub-compressed, 2-flowered; lower floret male, the upper floret female or rarely hermaphrodite, falling at last with the contiguous joint of the rhachis, aristate or almost muticous; lower glume broad, obovate or ob-cordate, truncate or emarginate, muticous, margins flat, not inflexed, not keeled, sometimes a little curved at the base; upper glume narrow, sub-carinate, margins incurved, muticous. *Lower floret* male, stamens 2, or neuter; lemma hyaline; palea often similar to the lemma. *Upper floret* female or hermaphrodite; lemma often shortly mucronate or aristate between the teeth at the summit, 1-nerved, palea hyaline, nerveless. *Lodicules* 0. *Stamens* often absent in the upper floret, rarely 2; anthers

linear. *Styles* very short; stigmas long linear, shortly pubescent, exserted from the apex of the spikelet. *Caryopsis* small narrowly oblong; embryo broad, half the length of the caryopsis.

Low grasses. Leaves narrow.

Apocoris paleacea (*Trin.*) *Hochr.*, in Bull. N. Y. Bot. Card. 6; 262. (1910) Syn. *A. Royleana* *Nees* in Proc. Linn. Soc. 1. (1841) 94.

A perennial grass with a creeping rhizome. *Culms* 2-1 m. tall, ascending, obscurely grooved, long exserted at the top. *Leaf-blades* broadly lanceolate-linear, acuminate, base hardly contracted, rounded, 4-12 cm. long, 4-10 mm. broad, the older leaves flat, rigid, green, almost erect, hairy with scabrid margins; sheaths lax, striate, with many tubercle-based hairs between the nerves, throat hairy; ligule very short, truncate, erose.

Inflorescence of erect racemes, 2-4-nate, 3-4 cm. long, glabrescent, streaked with purplish-black and straw-yellow; common peduncle exserted; joints of the rachis about $\frac{3}{4}$ - $\frac{1}{4}$ the length of the spikelet, rather thick; disarticulation transverse; margins usually ciliate with long reddish hairs. *Sessile spikelets*, 4-5 mm. long, truncate, obovate or subcuneiform-obvate, almost muticous, all alike; callus obtuse, with hairs 1-1.25 mm. long; lower glume 3.75-4.75 mm. long, coriaceous-papyraceous, broad truncate at the top, toothed and slightly ciliolate, back flattish, glabrous, smooth or scaberulous, 6-10-nerved, violet black in herbarium, dark brown in living specimens, save at the top, which with the margins is whitish-yellow; upper glume 4.5 mm. long, papyraceous, broadly oblong, truncate, top slightly ciliolate, margins inrolled, 3-5-nerved, glabrous, brown. *Lower floret* male; lemma 4.5 mm. long, hyaline, ovate-oblong, narrowly truncate, summit ciliolate, margins flat, 1-nerved; palea similar to the lemma, nerveless; anthers 3 mm. long. *Upper floret* female or hermaphrodite; lemma 3.75-4.75 mm. long, hyaline, lanceolate, 2-toothed, with obtuse teeth, mucronate, or shortly awned, with 1 thick nerve;

awn with a sub-twisted base, 3-5 mm. long; palea 3·5-4·5 mm. hyaline, ovate, truncate, nerveless, glabrous. *Stamens* 0, rarely 2. *Stigmas* 4 mm. long. *Pedicel* sterile, 1-2 mm. long, thin, with yellowish hairs.

Common in the KHASI and JAINTIA HILLS on grassy slopes 2-5,000 ft.

14. SORGHUM Pers.

Spikelets 2-nate, those of each pair different in shape and sex, one sessile the other pedicelled or represented by a pedicel only, on the articulate fragile or (in cultivated forms) tough rhachis of panicle few-jointed racemes; the sessile spikelet falling with the contiguous joint and the accompanying pedicelled spikelet or at least its pedicel. *Florets* 2, the lower reduced to an empty lemma, upper hermaphrodite in the sessile, male or neuter in the pedicelled spikelets if present at all. Sessile spikelets dorsally compressed. *Glumes* equal, coriaceous, at least when mature, rarely permanently chartaceous, muticous, upper with a broad flattened or convex back, with the margins narrowly inflexed near the tips and otherwise involute; upper boat-shaped, keeled upwards with narrow hyaline, usually upwards ciliolate, margins. *Lemmas* hyaline, ciliate, of lower floret 2-nerved or nerveless, of upper oblong to ovate, 2-dentate or 2-lobed with the lobes free, or more or less adnate to a perfect, or more or less reduced, awn or a mucro arising from the sinus, rarely entire and mucronate or muticous, 1- or 3-nerved. *Lodicules* 2, glabrous or ciliate; palea hyaline, often minute or 0. *Stigmas* laterally exserted; styles terminal or sub-terminal. *Caryopsis* mostly ovoid. *Pedicelled* spikelets if present much narrower than the sessile, lanceolate to subulate, male or neuter, sometimes reduced to the glumes or one glume only, or quite suppressed. *Glumes* permanently herbaceous, like the 2-1-nerved hyaline lemmas, awnless.

Annual or perennial, often robust grasses. *Leaf-blades* convolute in the bud, usually flat, herbaceous, often large. *Panicles* erect or nodding with verticillate, or scattered branches, often large in the spontaneous species, mostly loose

in the cultivated forms, frequently narrowly contracted to compact.

Key to the species of *Sorghum*.

- Primary branches of the panicle undivided,
up to 10 cm. long. 1. *S. nitidum*.
Primary branches of the panicle branched, up
to 20 cm. long. 2. *S. halepense*.

1. ***Sorghum nitidum* Pers.**, Synops. Pl. 1. (1805)
101. *Syn. Andropogon nitidus* Kunth, Revis. Gram. I. (1829).
166. *Andropogon serratus* Thunb., Flor. Jap. (1784) 41.

A tall tufted erect grass 1 m. to 2·5 m. high; culms densely villous at the nodes. *Leaves* setaceous acuminate, 20-60 cm. long, up to 1 cm. broad, with a prominent white midrib, glabrous or sparsely hairy on both surfaces; hairs often tubercle-based; margins scabrid, often coarsely so, thickened and cartilaginous; sheath terete below, sub-keeled above, glabrous or more or less hairy with a silkily villous mouth; ligule 1·1·5 mm. long, membranous, truncate.

Inflorescence an elongate panicle, oblong; rhachis glabrous; lower branches distantly whorled, upper alternate; branches capillary, flexuous, delicately scabrid, naked below. *Racemes* at the ends of the branches, few-spicate. *Spikelets* 2-nate, differing in shape and sex, the pedicelled often being represented by the pedicel only or a rudimentary spikelet. Joints and pedicels ciliate on the margins, 2/3 the length of sessile spikelet, callus densely hairy. *Sessile spikelets* broadly oblong, elliptic-acute or obtuse in outline, 4 mm. long, callus rounded; lower glume, shape of the spikelet, dorsally flattened with incurved margins, brown hairy and hispid on the keels, 5-7-nerved, very dark brown or black, polished when ripe; upper glume similar in size, rounded on the back, obtusely acuminate, hispid at the top; margins hyaline, ciliate. *Lower floret* barren; lemma 3·5 mm. long, hyaline, margins inrolled clasping the base of upper floret, 2-keeled, ciliate; palea absent. *Upper floret* hermaphrodite; lemma ovate, 2 mm. long, hyaline ciliate on the margins, shortly awned or not; stigmas 2, feathery; anthers 3, 2·5 mm. long; palea absent.

Very common in grassland in the hills. It may be found in flower from August to December.

2. Sorghum halepense (Linn.) Pers., Synops. Pl. I (1805) 101. **Syn. Andropogon halepensis Brot.,** Flor. Lusit. I (1804) 89.

A perennial grass from a long creeping stoloniferous rootstock. *Culms* up to 2·5 m. tall, sometimes decumbent at the base with numerous adventitious roots, erect, simple or sparingly branched, leafy; nodes finely silky pubescent. *Leaves* broadly linear-lanceolate, setaceous acuminate, somewhat tapering to the broad, rounded, sub-amplexicaul base, glabrous, smooth; margins scabridly serrulate; midrib stout; junction of sheath and blade often pubescent; sheaths somewhat loose, glabrous, striate; ligules short, membranous, erose, strigose behind.

Inflorescence a decomound panicle, 15-30 cm. long, branches 1-3-nate, distant, sub-erect, diffuse, angled and often scaberulous on one of the angles, villous at the axils, naked for half their length; racemes at the tops of the branches and branchlets, 10-25 mm. long, 3-4- or more-noded; joints and pedicels similar, nearly as long as the spikelets. *Sessile spikelet* ovate-lanceolate, elliptic, or narrowly elliptic, acute, 4-5 mm. long. *Lower glume* dorsally flattened or convex, ovate or elliptic-acute, 5-12-nerved, margins involute; *upper glume* lanceolate, acuminate, chartaceous, shining, 5-7-nerved. *Lower floret* barren; lemma broadly lanceolate, hyaline, margins inflexed. *Upper floret* hermaphrodite; lemma 2·5-3 mm. long or somewhat longer, obtuse, ciliate, 2-lobed, with an awn up to 12 mm. long from the sinus or the awn quite suppressed; palea narrow, hyaline, minute or absent. *Pedicelled spikelets* as long as the sessile but much narrower; lower glume narrow-lanceolate, 7-nerved, dorsally grooved, keels hispid, margins inflexed; upper glume cymbiform, lanceolate, acuminate, 5-nerved. *Lower floret* barren; lemma 2-keeled, glabrous, sparsely ciliate; upper floret male or neuter or quite absent. *Stamens* 3. Anthers 3 mm. long; lodicules 2 cuneate, ciliate on the angles.

Not common. Found in the plains.

15. PSEUDOSORGHUM A. Camus.

Annual. *Panicle* contracted dense; primary branches almost always solitary, erect, divided to the base, the secondary sometimes verticillate. *Racemes* spiciform, dense, sessile or almost so; rhachis fragile; joints and pedicels slender without a translucent groove, hairy; joints without appendages. The pedicelled spikelets all different from the sessile in shape and sex, male or neuter, more or less reduced, the sessile very imbricate, dorsally compressed, lanceolate; callus small hairy, lower glume with ciliate keels; upper glume more or less keeled. *Lower floret*; lemma almost equalling the glumes. *Upper floret*; lemma much shorter, with a slender sometimes caducous awn; palea equal to the lemma, smaller or absent.

Culms decumbent at the base finally erect. *Leaf-blades* linear or sub-lanceolate-linear, flat, rigid, somewhat glaucous; sheaths compressed, narrow or lax, hirsute or glabrous.

Pseudosorghum fasciculare A. Camus in Bull. Mus. Hist. Nat. Paris XXVI (1920) 662. Syn. *Andropogon fascicularis* Roxb., Fl. Ind. I (1832) 265.

Culms 6-1·5 m. tall, erect but decumbent and branching at the base, slender, rounded, glabrous, bare at the top, simple or bearing flowering branches. *Leaf-blades* linear to sub-lanceolate-linear, 30-50 cm. long by 4-8 mm. wide, contracted at the base, acuminate-setaceous at the tip, flat, rigid, glaucescent, scaberulous; median nerve somewhat thick; sheaths compressed, tight or somewhat lax, hirsute or almost glabrous, throat hairy; ligules 2 mm. long, ovate, often ciliate.

Inflorescence an oblong panicle 2·5-8 cm. long, green or purplish; main axis slender, glabrous, hairy at the nodes; branches almost always solitary, alternate, erect, divided to the base and shortly naked; racemes spiciform, sub-sessile, 1·6-2 cm. long, rather slender, spreading, erect or almost erect, sparsely hairy, of 2-6 flattened rhachis joints, smooth; joints and pedicels linear, round or compressed, distinctly stiff-ciliate with white or purple hairs. Sessile spikelets 4-5 mm. long, lanceolate; lower glume coriaceous, papyraceous, ovate-lanceolate, narrowly truncate at the top, glabrous and flat on the

back, smooth, shining, 7-9-nerved, with keels shortly ciliate towards the top, obtuse, hairy; hairs 1·3-1·7 mm. long; upper glume papyraceous, elliptic-lanceolate, acute, keeled below the summit and scaberulous, the rest very glabrous, shining, 5-7-nerved. *Lower floret*: lemma 4-5 mm. long, lanceolate; margins infolded, 2-nerved ciliate. *Upper floret* hermaphrodite; lemma much shorter, bifid, lobes triangular, ciliate; awn 8-15 mm. long; column blackish; palea equal or smaller than the lemma, broadly ovate or lanceolate, sometimes absent. *Stamens* 3; anthers 1·5 mm. long. *Pedicelled spikelets* male or neuter, 3·5-4 mm. narrower than the others; lower glume many-nerved with scaberulous keels; upper glume acute, 7-nerved. *Lower floret*: lemma obovate-oblong, ciliate.

Fairly common in the plains districts.

16. VETIVERIA Thouars ex Virey.

Spikelets 2-nate, of each pair sub-similar, differing in sex, one sessile the other pedicelled, on the articulate fragile rhachis of copiously whorled, rarely panicle, peduncled, 3- to many-jointed racemes, the sessile spikelets falling with the contiguous joint and the accompanying pedicelled spikelet, or at least the accompanying pedicel; joints and pedicels slender, slightly and gradually thickened upwards. *Florets* 2, lower reduced to an empty lemma, upper hermaphrodite in the sessile, male in the pedicelled spikelets. *Sessile spikelet* slightly compressed laterally, awned or awnless. *Glumes* equal; lower more or less coriaceous or chartaceous with a broad rounded back and sub-inflected margins, muriculate over the back, usually muticous; upper boat-shaped, keeled upwards, with broad, hyaline, ciliate margins, spinous-keeled, muticous, mucronate, or aristate. *Lemmas* hyaline, of the lower floret 2-nerved, of the upper minutely 2-dentate, muticous or mucronate, with a perfect or imperfect awn from the sinus. *Palea* minute, hyaline, nerveless. *Lodicules* 2, glabrous. *Stamens* 3. *Stigmas* laterally exserted. *Styles* sub-terminal. *Grain* oblong, top slightly oblique. *Pedicelled spikelet* dorsally compressed; glumes much thinner than in the sessile spikelet, like the lemmas usually awnless.

Coarse perennial glabrous grasses with short rhizomes. *Culms* stout, more or less compressed below. Lower leaf-sheaths much compressed, flabellate, imbricate; blades firm to hard, conduplicate in the bud, then flattening out at least upwards, gradually passing into the sheath.

Vetiveria zizanioides (*Linn.*) *Nash* in *Small, Fl. Southeast U. S.* (1903) 67. *Syn. Andropogon squarrosus* *Hook. f.* (*non Linn. f.*) *F. B. I. VII* (1897) 186; *A. muri-catus* *Retz.*, *Obs. Bot. III* (1783) 43.

Culms stout, up to and over 2 m. high, from an aromatic rhizome, usually sheathed all along. *Leaf-blades* linear, acute, 30-90 cm. long, 4-20 mm. wide, erect, rigid, firm, or somewhat spongy, usually glabrous, rarely more or less hairy downwards on the upper surface, pale green; midrib slender; lateral nerves close; sheaths compressed, particularly the lower, which are sharply keeled, fan shaped, imbricate, very smooth, firm; ligules reduced to a scarious rim.

Panicle oblong, up to over 30 cm. long, usually contracted; *rhachis* stout, smooth; whorls 6-10 with up to 20 rays; branches oblique to sub-erect, filiform, slightly rough. *Racemes* 5 (rarely 7.5) cm. long, very slender; joints about as long as the sessile spikelets or sometimes distinctly exceeding them in length, smooth or more or less rough, minutely and unequally ciliate at the slightly oblique tips; pedicels similar but shorter. *Sessile spikelets* linear-lanceolate to almost linear, acute or sub-acute, 4-4.5 mm. long, yellowish, olive; violet-brown, or purplish to almost black; callus obtuse, less than 1 mm. long, glabrous. *Glumes* acute coriaceous; lower muriculate all over the back, 5-nerved; lateral nerves close, very fine; upper glume spinulose muricate on the keel. *Lemma* of the lower floret as long as the glumes, acute, retrorsely ciliate. *Upper floret* hermaphrodite; lemma up to 3 mm. long, narrow oblong-lanceolate, mucronulate, eciliate. *Anthers* 2-3 mm. long. *Pedicelled spikelet* sparingly aculeolate or almost smooth; lemma of upper floret, entire, acute.

Mdlle. A. Camus, *Bull. Mus. Paris* (1919) 673, has two varieties both of which occur in Assam.

Spikelets muticous { Callus with short white hair. var. *genuina*.
 { Callus with yellow hair about
 | the length of the spikelet. var. *tonkinensis*.

This is the well-known khas-khas grass from which an oil, much used in perfumery, can be extracted.

A very common grass in the plains.

17. CHRYSOPOGON Trin.

Spikelets in threes at the ends of the branches of terminal panicles, one sessile the other two pedicelled, the two falling entire from the thickened, nearly always bearded, oblique tips of the peduncles; exceptionally 2-nate in 2-jointed racemes, one sessile and the other pedicelled, each sessile spikelet falling with the contiguous joint and its pedicelled companion, pedicels (and joints where any) linear, filiform, nerved, longitudinally grooved or appendaged. *Florets* 2; lower reduced to an empty lemma, upper hermaphrodite in the sessile, male or neuter in the pedicelled spikelet. *Sessile spikelets* usually laterally compressed, awned. *Glumes* sub-equal; lower coriaceous or chartaceous, involute with a rounded back, or complicate and more or less keeled upwards, upper boat-shaped, more or less keeled. *Lemmas* hyaline; of lower floret 2-nerved, of upper linear, entire or 2-dentate, with a usually perfect awn from the sinus. *Palea* 0 or small, hyaline, nerveless. *Lodicules* 2, small glabrous. *Stamens* 3; stigmas exserted laterally low down. *Caryopsis* linear, laterally compressed; embryo half the length of the grain. *Pedicelled spikelet* dorsally compressed, awnless or aristate.

Mostly perennial grasses. *Leaf-blades* narrow. Panicles usually lax, of whorls of simple or basally divided, filiform branches, rarely the branches 2-nate or solitary.

Key to the species of *Chrysopogon*.

Pedicels of the pedicelled spikelets glabrous :—

Base decumbent; panicle 2·5-10 cm. long,
contracted; spikelets 2-4 mm. long. 1. *C. aciculatus*.

Base erect; cæspitose grass, tall; leaves 12-35
cm. long; spikelets 7-10 mm. long. 2. *C. gryllus*.

Pedicels of the pedicelled spikelets hairy :—

Spikelets 8-9 mm. long. 3. *C. orientalis*.
Spikelets 6-7 mm. long. 4. *C. lancearius*.

I. **Chrysopogon aciculatus** Trin., Fund. Agrost. (1820) 188. Syn. Andropogon aciculatus Retz. Obs. V (1789) 22.

A perennial grass. *Rhizome* creeping, woody. *Culms* 20-60 cm. long; base rather slender, creeping, rooting and branching at the lower nodes, decumbent, finally ascending, glabrous even at the nodes. *Leaf-blades* rather close below, the upper spreading narrow, linear, rounded at the base, obtuse or acute, 2-15 cm. long, 3-5 mm. wide, those at the top very small, soft, the older leaves flat, often wavy at the margins, glaucescent, without hairs or with scattered hairs at the base, smooth; margins spinous; sheaths rounded, not auricled, narrow, glabrous or slightly bearded at the throat, the upper shorter than the internodes, the lower much longer; ligules membranous, narrow.

Inflorescence a panicle, erect, narrow, oblong or linear-oblong, spreading, 2.5-10 cm. long; principal axis robust, smooth, straight; branches 4-5-nate, fragile, slender, filiform, spreading, back convex not channelled, the longest 1-1.5 cm. long, all hairy, scabrid, and thickened at the top, articulating very obliquely with the hermaphrodite spikelets on only one joint, the same node carrying the hermaphrodite sessile and the two male or neuter pedicelled spikelets; articulation without an appendage; margins almost dilated, scabrid above. *Sessile spikelets* hermaphrodite linear, 2-4 mm. long, compressed dorsally, aristate; callus needle-shaped, narrowly incurved, decurrent on the pedicel, equaling the spikelet in length, glabrous, shortly hairy on the margins towards the insertion of the upper glume; hairs 1 mm. long. *Lower glume* 2-4 mm. long, papyraceous, linear-subulate, narrowly truncate and sometimes bimucronulate, involute at the base, broadly implicate towards the top, back convex, scabrid at the top, smooth at the base, obscurely 2-3-nerved; keels 2. *Upper glume* 2-4 mm. long, lanceolate-acuminate, shortly aristate, back sub-coriaceous, margins hyaline, keels aculeolate or scabrid-setulose at the top, glabrous. *Lower floret*; lemma 1.5-3 mm. long, hyaline, linear-oblong, somewhat obtuse or acute, 2-nerved; cilia retrorse. *Upper floret* hermaphrodite; lemma membranous;

linear-acuminate, glabrous or ciliolate at the top, entire and carrying a terminal not twisted awn which is scabrid and 4-8 mm. long; palea short, linear-obtuse, nerveless, glabrous. *Lodicules* cuneiform. *Stamens* 3; anthers scarcely 1 mm. long. *Caryopsis* linear. *Pedicelled spikelets* male, 5-6 mm. long, narrower than the sessile, subulate, lanceolate, glabrous; lower glume 5-6 mm. long, subulate, lanceolate, dorsally convex, keels ciliate at the summit, 3-nerved, terminating in an awn which is $\frac{1}{2}$ - $\frac{1}{3}$ the length of the glume; upper glume 4.5-5.6 mm. long, membranous, acuminate, back convex, 3-nerved, cilia retrorse. *Lower floret*; lemma shorter, hyaline, oblong-acuminate, cilia retrorse; palea small, cuspidate. *Upper floret*; lemma short, broad, cilia retrorse; palea linear-oblong, glabrous. *Anthers* 1.8-2 mm. long. *Pedicel* 1.5-3 mm. long, compressed, linear, glabrous, scaberulous, with thick hair below the spikelet.

Very common in plains and hills, especially in grazing grounds.

2. Chrysopogon gryllus Trin., Fund. Agrost. (1820)
188. Syn. Andropogon gryllus Linn., Cent. Pl. II. 33.

Perennial, densely caespitose; innovations extra-vaginal mixed with intravaginal. *Culms* erect simple, 6-160 cm. tall, terete or compressed, often scaberulous or rough above, now and then very glabrous, striate. *Leaves* 12-35 cm. long, 4-8 mm. wide, not distinct from the sheath, linear, acute, glabrous or hirsute, flaccid, bright green; margins very scabrid: sheaths of the innovations very compressed, dilated at the base, often with appressed hairs, those of the culms slightly compressed, carinate above, smooth or scaberulous, glabrous or hairy above; margins glabrous or ciliate; ligule a very narrow, ciliate, membranous ring.

Panicle 7.5-20 cm. long, branches whorled, 5-8 cm. long, usually many, tip of the branches obliquely truncate, densely bearded. Main axis angular, scabrid on the angles, axis bearded or glabrous. *Sessile spikelets* linear, callus straight acute, 7-10 mm. long; lower glume finally cartilaginous, coriaceous, shining, smooth or scaberulous; margins broadly involute, 7 mm. long; upper glume 7.25 mm. long, charta-

ceous, lanceolate, hyaline; margins ciliate; awn as long as the spikelet or shorter. *Lower floret*; lemma 5.5 mm. long, obtuse, nerveless; margins ciliate. *Upper floret* hermaphrodite; lemma as long as the lower lemma, minutely and auctely 2-toothed, 1-nerved, glabrous or ciliate; awn minute or up to 3.5 cm. long; palea small, oblong, obtuse, nerveless, glabrous; anthers 4 mm. long. *Pedicelled spikelets* rather longer than the sessile, linear lanceolate, usually of a violet colour; pedicels glabrous or ciliate; lower glume acuminate or aristulate, 5-9-nerved; keels ciliate above; upper glume lanceolate-acuminate, ciliate; lower lemma equal to the upper lemma 6.8 mm. long; palea as long.

Common in the hills 4-6,000 ft., usually in dry situations.

3. Chrysopogon orientalis A. Camus in Lecomte, Flor. Gen. de l'Indo-Chine VII (1922) 332. Syn. *Andropogon wightianus* Hook. f., F. B. I. VII (1897) 191.

A perennial grass. *Culms* 50-90 cm. tall, ascending, slender, branching or not, almost compressed, glabrous. *Leaf-blades* narrow, a little rounded at the base, distinct from the sheath, obtuse or almost so, 3-10 cm. long, 3-4 mm. wide, flat or rolled when mature, stiff, green, puberulous or glabrous, long fimbriate at the base; margins scabrid; sheaths of the innovations very compressed, with an almost bulbous base, often with appressed hairs, those of the culms somewhat compressed, carinate above, hairy or not at the top, smooth or seaberulous, tight, shorter than the internodes; ligule a rim of short hairs.

Inflorescence a decompound panicle, oblong, erect, 9-18 cm. long; main axis scaberulous, branches 4-12-nate, somewhat thickened at the top, scaberulous, fragile, with very oblique articulations; scar linear, oblong, ciliate. *Sessile spikelets*, hermaphrodite, linear, pale green or brownish, awned, often laterally compressed, 8-9 mm. long; callus acute, incurved, 3 mm. long, covered all over with reddish-rusty hairs 3.5 mm. long. *Lower glume* 8.8-5 mm. long, coriaceous, papyraceous, very obtuse, with a very glabrous back, convex towards the base, compressed above and hispid, margins glabrous and involute, 2 nerved; upper glume 8-9

mm. long, clasping at the base, coriaceous, margins hyaline, membranous, broadly oblong, hispidulous at the top and on the margins, back convex, 3-nerved; awn 12-15 mm. long, with a scarcely dilated base, covered with stiff spreading hairs. *Lower floret*; lemma 8-8.5 mm. long, linear-obtuse, nerveless, ciliate, cilia retrorse. *Upper floret*; lemma 8.9 mm. long gradually terminating in a subulate awn 5-6 mm. long, column golden yellow, white-hispid, flexuous; lodicules small, glabrous; stamens 3; anthers 4-5 mm. *Stigmas* yellowish. *Pedicelled spikelets* male, 10-12 mm. long, pale violet in colour, linear-lanceolate, dorsally compressed, often hispidulous; lower glume with 1-7 equal distant nerves, keel somewhat ciliate, awned; awn equal to the glume or longer; upper glume 3-nerved, ciliate; muticous or shortly aristate. *Lower floret*; lemma 2-nerved. *Upper floret*; lemma shorter than the upper glume, 1-nerved, hyaline, cilia retrorse; palea small. *Anthers* 4.5 mm. *Pedicel* 7-11.5 mm. linear-sub-claviform, with rigid cilia on the margins, reddish, 2-3 mm. long.

Not yet recorded but is likely to occur in the western districts.

4. ***Chrysopogon lancearius* (Hook. J.) Haines**, Bot. B. & O. (1924) 1036. Syn. *Andropogon lancearius* Hook. f., F. B. I. VII (1897) 190.

Perennial. *Culms* 120-180 cm. tall, compressed, with dry leaf-sheaths below, very leafy above, minutely downy below the panicle. *Leaf-blades* narrowly lanceolate, acuminate, narrowed towards the base, quite glabrous, flat, smooth, midrib broad, white above, nerves many; margins spinulose and sharp; sheaths imbricate, compressed, tight, striate, smooth and glabrous; ligule a row of very fine short hairs.

Inflorescence an oblong panicle 15-30 cm. long, many-rayed, with irregularly verticillate, capillary sub-erect branches, 5-10 cm. long, which exhibit the characteristic clavate, oblique, brown-bearded tips which are to be seen after the fall of the spikelet; pedicels compressed, somewhat translucent, bearded on each margin with long brown hairs, about 1-1.5 mm. long or longer. *Sessile spikelets* 6.25 mm. long; callus elongate, glabrous in front, pungent and with

a barb of brown hairs, shortly adnate to the oblique, brown-bearded tip of the peduncle. *Lower glume* conduplicate, tip oblique, 2-nerved on each side, slightly scaberulous on the nerves; upper as long but much broader, conduplicate, each side 1 mm. broad; keel rounded, 3-nerved, and broad membranous; margins pilose; awn 7·5-10 mm. long, slender. *Lower floret*; lemma 1 mm. long, reaching the tips of the anthers, ciliate. *Upper floret* hermaphrodite; lemma membranous, linear, not 2-fid but the sides meeting in front of the awn, which is 3-5 cm. long, short and hairy up to the knee, then slender and scabrid. *Pedicelled spikelet*; lower glume lanceolate, 8 mm. long, papyraceous, awned from the tip (awn 7 mm. long) 7-nerved, sparsely hairy on the median nerve dorsally, margins clasping the upper glume; upper glume lanceolate, membranous, 3-nerved, hairy on the nerves, ciliate on the inturned margins. *Lower floret* empty; lemma 5 mm. long, hyaline, ciliate on the margins, nerveless. *Upper floret* male; lemma linear-oblong, acute, 2-nerved, sparsely ciliate on the back and margins; palea lanceolate 1·5 mm. long, hyaline; stamens 3; anthers 3·5 mm. long; lodicules 2, cuneiform, glabrous.

GOALPARA and DARRANG.

18. CAPILLIPEDIUM Stapf.

Spikelets 2-nate, one sessile, the other pedicelled, similar in shape, differing in sex, in 1-2 (rarely up to 8-) jointed racemes at the ends of the capillary, primary and secondary and often tertiary or even quarternary, branches of a loose panicle; joints and pedicels finely filiform, longitudinally grooved and hyaline in the grooves, disarticulating horizontally; sessile and pedicelled spikelets deciduous, the former with the adjacent joint and pedicel. *Florets* 2 in the sessile spikelet, lower reduced to an empty lemma or quite suppressed in the pedicelled spikelets, upper hermaphrodite, male or neuter in the pedicelled spikelets. *Sessile spikelet* dorsally compressed, awned; callus small, shortly bearded. *Glumes* equal, membranous to sub-herbaceous; lower 2-keeled with narrow inflexed margins; upper boat-shaped, 3-nerved, keeled, grooved on both sides of the obtuse keel.

Lemna of lower floret hyaline, nerveless, of the upper floret reduced to a hyaline linear stipe, firmer upwards, passing into a slender awn; palea absent. *Lodicules* 2, minute, glabrous. *Stamens* 3. *Stigmas* exserted laterally, longer than the styles. *Grain* oblong ellipsoid or oblong, dorsally slightly compressed; embryo exceeding half the length of the grain. *Pedicelled* spikelet awnless, lemma if present, nerveless, hyaline.

Annual or perennial grasses with slender culms, simple or branched, sometimes very copiously, frequently bearded at the nodes. *Leaf-blades* with a rather conspicuous white midrib. *Panicles* delicate, when much divided the branchlets at length more or less divergent.

Key to the species of *Capillipedium*.

Stems stout; robust grasses; peduncles of racemes not ciliate.

Lower glumes of sessile spikelets dorsally channelled, base of blades hardly narrowed; spikelets oblong obtuse. 1. *C. parviflorum*.

Lower glume of sessile spikelet flat; leaf-blades much narrowed and gradually tapering; spikelets lanceolate. 2. *C. assimile*.

Stems slender, peduncles pectinately ciliate. 3. *C. pteropechys*.

1. *Capillipedium parviflorum* Stapf in Dyer, Flor. Trop. Afr. IX (1917) 169. Syn. *Andropogon micranthus* Kunth, Revis. Gram. I. 165.

A perennial grass; innovation shoots extravaginal, thin; cataphylls more or less hairy, at length glabrescent. *Culms* tufted, to over 1 m. high, erect or shortly ascending at the base, simple or sparingly branched, terete, internodes sometimes channelled on the side facing the subtending leaf, glabrous. *Leaf-blades* linear from an often narrowed and slightly contracted base, long tapering to a fine point, up to almost 30 cm. long, 2-5 mm. broad, rather rigid and often spreading, flat, glabrous or more often pubescent all over to hirsute, particularly just above the ligule, margins rough, lateral nerves fine, 3-4 on each side.

Panicle oblong, 10-25 cm. long, 2·5-6 cm. wide, erect, more or less decomound, primary branches sub-verticillate,

often 5-7 or more from the lowest nodes, unequal, and divided from lower down and up to the 3rd degree, glabrous or hairy at the insertion, minutely puberulous all along, usually dark purple to almost black, ultimate branches (peduncles) 12-20 mm. long. Racemes reduced to 1 sessile and 2-pedicelled spikelets, or 2-rarely 3-jointed; joints and pedicels 1-3 mm. long, shortly ciliate or sometimes glabrous. *Sessile spikelet* oblong, 2-3.5 mm. long, usually dark purplish or reddish to olive-brown. *Glumes* more or less membranous, lower minutely truncate, very shallowly concave along the middle on the back, about 6-nerved (2 intercarinal), scabrid all over, ciliate upwards on the keels; upper scaberulous upwards on the keel. *Lemina* of lower floret 2.2-5 mm. long; awn including stipe 1.25-1.9 cm. long, fine. *Anthers* 1.6-1.8 mm. long. *Pedicelled spikelet* usually male, very similar to the sessile or somewhat smaller, narrower and paler. *Lower glume* acute, 7-nerved; keels ciliolate upwards. *Upper floret* suppressed.

Rather uncommon, KHASI and NAGA HILLS, 4-6,000 ft.

2. *Capillipedium assimile* A. Camus in Lecomte, Flor. Gen. de l'Indo-Chine VII. 314. Syn. *Andropogon assimilis* Steud., Syn. Pl. Glum. (1854) 397.

Perennial. *Culms* 1.8-3.5 m. tall, suffrutescent, decumbent and rooting at the base, branching, internodes very glabrous, round but flattened on one side, nodes pubescent, branches spreading. *Leaf-blades* flat, almost lanceolate, linear, base very narrow, insensibly acuminate-setaceous, 6-15 cm. long, 3-6 mm. broad, flat, spreading, soft, glabrous or hispidulous, often scaberulous, with the margins spinous toothed, median nerve somewhat thick, broad and white above; sheaths somewhat compressed, subcarinate, the lower slipping from the culm, all shortly bearded in the throat, nodes sometimes hairy, smooth or scaberulous; ligules short, truncate, ciliolate or hairy.

Inflorescence a decompound panicle 5-12 cm. long, slender, erect, ovate oblong or triangular, branched to the 3rd degree; common axis slender; branches and branchlets capillary, spreading at a right angle after anthesis, bearded

in the axils, naked at the base; the primary solitary rarely opposed, the secondary numerous; racemes 7-10 mm. long, peduncled, 2-3 jointed; rhachis smooth, fragile; joints and pedicels 1·5-2·5 mm. long, filiform, back deeply channelled, hyaline; margins ciliate or glabrescent; hairs ·75-1·25 mm. long, often absent at the top; articulations without appendages. *Sessile spikelets* linear-oblong, 2-3·5 mm. long, all hermaphrodite, dorsally compressed, pale green or reddish, aristate; lower glume membranous, oblong or linear-oblong, margins narrow inflexed, 2-keeled, very narrowly truncate at the top, somewhat depressed on the back, towards the top glabrescent, with stiff cilia on the keels, delicately 2-5-nerved; callus small, shortly bearded; upper glume 2-3·5 mm. long, broadly lanceolate and ciliolate at the apex, acute or mucronate, sub-depressed towards the obtuse keel, margins glabrous, 3-nerved. *Lower floret* barren; lemma ·75-1·25 mm. long, hyaline, ovate, obtuse, nerveless, glabrous. *Upper floret* hermaphrodite; lemma 1·2 mm. long, narrow, glabrous; awn very slender 6-12 mm. long; palea absent. *Lodicules* glabrous. *Stigmas* oblong, broadly plumose, almost twice as long as the styles. *Pedicelled spikelets* male or neuter, 3·5 mm. long, linear-lanceolate, rusty; lower glume linear-lanceolate, acute, green or reddish, keel ciliolate, the remainder glabrous, 7-nerved; upper glume 3·5 mm. acute 3-5-nerved, ciliolate. *Lower floret* barren; lemma shorter, oblong, obtuse, nerveless, glabrous. *Upper floret*; lemma absent. *Anthers* 1·2 mm. long, stamens scarcely absent.

I have followed Mlle. Camus in Flore Generale de l'Indo-Chine rather than Stapf in Hook. Icon. Plant. tab. 3085, who calls this plant *C. glaucopsis*.

A very common grass up to 6,000 ft.

3. *Capillipedium pteropechys* (*Clarke*) *Stapf* in Hook. Ic., Plant. sub tab. 3085. Syn. *Andropogon pteropechys* Clarke in Jour. Linn. Soc. XXV (1889) 88. t. 33.

Perennial. *Culms* very slender from a creeping root-stock, stout, 40-60 cm. high, terete, glabrous and smooth, finely striate, nodes bearded, sparingly branched or simple. *Leaf-*

blades 7·5-15 cm. long, linear-lanceolate, finely acuminate, narrowed towards the base, glabrous above, below sparsely hairy from tubercled bases, scaberulous on the upper surface, margins scarcely thickened, seabrid, midrib definite above as a white line; sheaths rather loose below, close and tightly fitting above, striate, smooth and glabrous, except for a few hairs at the collar and a few at the mouth; ligule a very narrow, ciliate rim; cilia stiff.

Inflorescence a very open panicle 5-7·5 cm. long, sparingly branched; branches filiform, smooth and glabrous except just below the lowest spikelet where they are pectinately ciliate; hairs white. *Racemes* usually few-spicate, about 1 cm. long, joints and pedicels ciliate on the margins, channelled, usually about half the length of the spikelet. *Spikelets* oblong, somewhat obtuse, erect; callus hairs equaling $\frac{1}{2}$ the length of the spikelet. *Sessile spikelets* 3·75-4·25 mm. long; lower glume oblong-obtuse, more or less rounded on the back, quite glabrous, keels pectinately ciliate, 9-nerved, nerves usually prominent; upper glume ovate-lanceolate, acute, 3-nerved, sparingly ciliate. *Lower floret* barren; lemma small, ovate, nerveless; palea absent. *Upper floret* hermaphrodite; lemma the linear base of an awn 1·5 cm. or more long; palea very small or absent. *Pedicelled spikelets* male or barren, rather narrower than the sessile and more acute; lower glume 9-11-nerved; upper glume thin membranous, 3-nerved; lemma oblong obtuse, glabrous and nerveless; anthers 2 mm. long.

This grass has, so far as I am aware, been only collected thrice : by C. B. Clarke on the Pulebadze-Japvo ridge about 8,500 ft. (and by me in the same place and also at Purr, in the Sangtam country, at, 6,000 ft.

19. BOTHRIOCLOA O. Kuntze.

Spikelets 2-nate, one sessile and the other pedicelled, similar in shape or the pedicelled reduced and smaller, the latter always different in sex except sometimes the lowermost pair which may be homogamous (male or neuter), on the fragile rhachis of many jointed, shortly peduncled, sub-digi-

tate or panicle racemes; joints and pedicels filiform longitudinally grooved and hyaline in the groove, disarticulating horizontally; sessile and pedicelled spikelets deciduous, the former with the adjacent joint and pedicel. *Florets* 2 in the sessile spikelets, lower reduced to an empty lemma, upper hermaphrodite, 2 or 1 in the pedicelled spikelet, the lower male or neuter, the upper neuter or usually quite suppressed. *Sessile spikelet* dorsally compressed, awned; callus small, shortly bearded. *Glumes* equal, thinly chartaceous to membranous; lower 2-keeled, with narrow sharply inflexed margins; upper boat-shaped, 3-nerved, acutely keeled. *Lemma* of lower floret hyaline, nerveless, of the upper floret reduced to a hyaline linear stipe, firmer upwards passing into a slender awn. *Palea* absent or very minute. *Lodicules* 2, minute, glabrous. *Stamens* 3. *Stigmas* exserted laterally usually low down, longer than the styles. *Caryopsis* oblong, obtuse, dorsally slightly compressed; embryo about half the length of the grain. *Pedicelled* spikelet awnless, lemmas (if present) hyaline, nerveless.

Perennial grasses with slender, simple or branched culms, bearded or beardless at the nodes. *Panicles* mostly sub-digitate with a short primary axis, rarely the racemes in branches of the second order; racemes always shortly peduncled. *Spikelets* small.

The genus *Bothriochloa* was published by Dr. Otto Kuntze in *Revisio Generum Plantarum II.* (1891) 762. In spite of the fact that Kuntze confines his genus to species "inflorescentia racemoso paniculata (haud racemoso digitata)" *Amphilophis pertusa* Stapf (*Andropogon pertusus* Willd.) has been transferred to this genus as it is obviously very closely allied to the other species with a paniculate inflorescence.

Key to the species of *Bothriochloa*.

Primary axis elongated, much longer than the lowest racemes, lower branches or at least the stronger sparingly divided, but not beyond the second degree.

1. *B. intermedia*.

Primary axis short, much overtopped by the racemes. Lower glumes of sessile spikelets with or without pits and hairy below.

2. *B. pertusa*.

1. *Bothriochloa intermedia* (*R. Br.*) *A. Camus* in Ann. Soc. Linn. Lyon, (1930) n. s. LXXVI (1931) 164. Syn, *Andropogon intermedius* *R. Br.* Prod. (1810) 202.

Perennial; rhizome very short, hard; innovations extra-vaginal; cataphylls ovate to lanceolate, acute, hard, smooth. Culms tufted, erect or shortly ascending to over 1 m. in height, terete, rather stout below, glabrous, 5-7-noded, simple or very sparingly branched. Leaf-blades linear, long tapering to a setaceous point, not or slightly contracted at the base, up to 30 cm. long, 6 mm. wide, pale green, glabrous, or rarely with soft white spreading hairs above the ligule, smooth except on the margins; sheaths terete, glabrous, smooth; nodes glabrous or the upper bearded; ligules truncate, very short, scarious.

Panicle narrowly oblong, 10-23 cm. long by 2.5-4 cm. broad, erect, primary axis much longer than the lowest racemes, somewhat stony, and when mature stiff, shortly bearded at the branch-axils, otherwise glabrous and smooth; branches whorled, up to 6 in a whorl, or semi-vermicillate, or 2-nate or solitary from the weaker nodes, straight, 2.5-7.5 cm. long, the longer divided from 1.5 cm. above the base, from 3-7-noded, secondary branches simple. Racemes 1.25-3.75 cm. long, straight or flexuous, usually purplish, inconspicuously white-villous; joints and pedicels 2-3 mm. long, ciliate; uppermost cilia much longer than the rest, up to 1 mm. long. Sessile spikelet pale green or purplish throughout, including the small, minutely bearded callus 3.3-3.5 mm. long. Glumes equal; lower truncate, slightly concave on the back, chartaceous membranous, hairy below the middle, more rarely glabrous, keels rigidly ciliolate upwards, intracarinal nerves 4-5, very fine, evanescent upwards, with or without a pit in the middle; upper-glume lanceolate, acute, 3-nerved, keel scabrid upwards; margins sparingly ciliate. Lemma of lower floret oblong, 2.5 mm. long, hyaline, nerveless, ciliate, awn of upper floret 6-12 mm. long, brown below, pale above the bend. Pedicelled spikelet neuter, mostly reduced to the glumes, narrowly linear-oblong to linear, 2.5-2.75 mm. long, glabrous, of the same colour as the sessile. Lower glume rigidly and minutely ciliolate, 5-9-

nerved, often rolled and not pitted; upper hyaline, nerveless often minute.

Common in the plains.

Bothriochloa intermedia (R. Br.) *A. Camus* forma *punctata* *A. Camus*.

This is the variety of this grass with a pitted lower glume in the sessile spikelet.

KHASI and JAINTIA HILLS, 4-6,000 ft.

2. Bothriochloa pertusa (*Willd.*) *A. Camus* in Ann. Soc. Linn. Lyon, (1930) n. s. LXXVI (1931) 164. Syn. *Andropogon pertusus* Willd., Sp. Pl. IV, 922.

Perennial; rhizome short, innovations extra- or more often intravaginal; cataphylls glabrous. Culms slender, terete, many nodded, sub-erect or geniculately ascending or often weak, trailing or rambling over the ground, rooting and throwing up tufted or single shoots from the nodes, glabrous. Leaf-blades linear, tapering to a fine point, hardly contracted at the base, 15 cm. long by 3-4 mm. wide, glabrous, pubescent or hirsute, often with tubercle based hairs; sheaths of the innovation shoots compressed, more or less keeled, the others terete, glabrous, smooth, usually bearded at the nodes; ligules very short, truncate, of lower leaves up to 2 mm. long, rounded, membranous, ciliolate.

Panicle sub-digitate, about 5 cm. long; primary axis filiform, 1·25-2·5 cm. long; branches opposite or solitary, rarely in scanty whorls, naked for 4 (rarely 6) mm., simple, glabrous, smooth. Racemes 3-6 cm. long, often flexuous, pale or dull purplish, whitish, silikily villous; joints and pedicels very similar, not much over 2 mm. long; ciliate, cilia much longer at the tip, (of the pedicels up to 3 mm. long). Sessile spikelet oblong, pale greenish, including the shortly bearded callus, 3-4 mm. long, beard up to 2 mm. long. Glumes equal; lower very minutely truncate, flat on the back, chartaceous-membranous, hairy below the middle, keels rigidly ciliolate upwards, intracarinal nerves 5-7 or more upwards, pit always present, usually very pronounced, corresponding to a firm bulb-like protuberance on the inner side; upper glume lanceolate, acute or mucronulate, 3-nerved, keel scaberulous,

margins ciliate upwards. *Lemma* of lower floret oblong, obtuse not much over 2 mm. long, hyaline, nerveless, minutely ciliolate at the top; awn of upper floret including the stipe, 12-20 mm. long. *Pedicelled spikelet* male or neuter, very like the sessile in shape and size, but usually darker. *Glumes* sub-equal, lower not pitted, about 7-nerved. *Lemma* like that of the sessile spikelet or more or less reduced. *Stamens* 3, anthers up to 1·5 mm. long, rarely absent.

NAGA HILLS 4,000 ft. but doubtless occurs in all districts.

20. DICHANTHIUM Willmet.

Spikelets 2-nate, one sessile, the other pedicelled, similar in shape, different in sex, except the lowermost 1 or 2 pairs of each raceme, which are (with occasional exceptions) homogamous (male or neuter) in many-jointed, shortly peduncled, sub-digitate, rarely sub-panicked or racemosely arranged racemes; joints and pedicels filiform, solid, disarticulating sub-horizontally except the lowest barren pairs; fertile sessile and pedicelled spikelets deciduous, the former with the adjacent joint and pedicel. *Florets* two in the sessile fertile spikelets (lower reduced to an empty lemma, upper hemaphrodite), one in the barren sessile and all the pedicelled spikelets, male or neuter, or suppressed. *Sessile spikelet* dorsally compressed, awned (except the basal homogamous ones); callus small, shortly bearded. *Glumes* equal, thinly chartaceous; lower usually very obtuse, 2-keeled with narrow, sharply inflexed margins; upper boat-shaped, 3-nerved, acutely keeled. *Lemma* of the lower floret hyaline, nerveless, of the upper floret reduced to a hyaline, upwards firmer, linear stipe, passing into a slender awn (very rarely finely 2-toothed, with the awn from the sinus). *Palea* absent or minute. *Lodicules* 2, minute, glabrous. *Stamens* 3. *Stigmas* exserted laterally or above the middle or near the tips. *Caryopsis* oblong, obtuse, dorsally compressed; embryo rather more than half the length of the grain. *Pedicelled spikelet* awnless; lemma, if present, hyaline, nerveless.

Perennial, very rarely annual, grasses with simple branched usually many-noded culms, bearded or beardless at the nodes. *Panicles* usually sub-digitate with a short or

very short primary axis, rarely the latter elongated; racemes always shortly peduncled. *Spikelets* small, rarely the male somewhat larger.

Key to the species of *Dichanthium*.

- Lower glume of the sessile spikelets obovate or oblong-truncate, winged, no median nerve; sheaths compressed; ligule a short ciliate membrane. 1. *D. caricosum*.
 Lower glume of the sessile spikelet oblong, obtuse or truncate; keel not winged, with a median nerve; sheaths terete; ligule membranous large. 2. *D. annulatum*.

1. *Dichanthium caricosum* A. Camus in Bull. Mus. Nat. Hist. Paris, XXVII, (1921) 549. Syn. *Andropogon caricosus* Linn., Sp. Pl. ed. 2, 1480.

A perennial grass; innovations often stoloniferous. *Culms* 30-60 cm. high, rooting at the nodes, geniculate-ascending, compressed, channelled on the surface corresponding to the back of the sheaths, very glabrous or with hairy nodes, simple or branched. *Leaf-blades* somewhat rigid, flat, narrowly linear, base rounded, setaceous-acuminate, green, 15-20 cm. long, 2.5-5 mm. broad, glabrous, almost smooth; margins scaberulous; median nerve keeled, broad and white above; sheaths somewhat loose, compressed, keeled, shorter than the internodes, throat not auricled, not spathiform; ligules very short, truncate, membranous, glabrous or ciliate.

Inflorescence of spiciform racemes which are either solitary, sub-digitate or falsely panicled, 2-4-nate, rather thick, silky, erect or flexuous and nodding, pale green, 2.5-10 cm. long; peduncle 5-15 mm. long; rhachis of the racemes many-jointed, rather fragile, joints and pedicels 1.3-1.6 mm. long, linear, filiform, back flat, margins with hairs, articulations oblique, without appendages; spikelets almost distichous, imbricate, the sessile of the lower 1-3 pairs different from the upper, male or empty, persistent. *Sessile spikelets* hermaphrodite, 4-5 mm. long, obovate-elliptic or obovate-oblong, rather narrow, compressed dorsally; lower glume thin, herbaceous-papyraceous, obovate or oblong, very

or hardly obtuse, sub-truncate denticulate, margins narrowly keeled and inflexed at the top, a little inturned at the base; margins silky with stiff cilia; back convex, glabrous and shining, 8-12-nerved, (no median nerve); nerves evanescent below the top; callus very short, broad, very shortly bearded; upper glume 4-5 mm. long, much narrower than the lower, inflexed, membranous-papyraceous, ovate-oblong, obtuse or somewhat acute, muticous, 3-keeled, depressed near the median keel. *Lower floret* barren; lemma 3·5-4·5 mm. long, hyaline, oblong, obtuse, nerveless, glabrous or ciliate. *Upper floret* hermaphrodite; lemma entire, narrow, awned; awn slender, 15-25 mm. long; column brownish, very scabrid, kneed in the middle. *Lodicules* glabrous, cuneiform. *Stamens* 3; anthers 2-3 mm. long, linear. *Ovary* glabrous, stigmas oblong. *Caryopsis* obovate-oblong, compressed on the ventral face, convex on the dorsal surface. *Pedicelled spikelets* male, 4-5 mm. long; resembling the sessile but flatter, hairier and more obtuse, broad, obovate, sub-claviform; pedicels linear, filiform, dorsally flattened, compressed; lower glume broadly oblong, silky, 15-19-nerved, keels and nerves rather longer ciliate; upper glume elliptic- or ovate-lanceolate, acute, shorter than that of the sessile spikelets, margins broadly inflexed, ciliate. *Lower floret*; lemma 2·5-3·5 mm. long, linear, oblong, acute, muticous, glabrous; anthers 2 mm.

Banks of the Brahmaputra in Lakhimpur.

2. *Dichanthium annulatum* Stapf Flor. Trop. Afr. IX. 178. Syn. *Andropogon annulatus* Forsk., Flor. Aeg. Arab. (1775) 173.

A densely caespitose perennial. *Culms* ·5-1 m. tall, erect or geniculate ascending, rather robust, often woody at the base, very leafy, smooth, nodes alternately flattened, simple or sparingly branchy. *Leaves* narrow, linear, setaceous-acuminate, flat, rigid, glaucous, papillose, scabrid at least on the upper surface, margins scabrid, glabrous or with appressed hairs above, 5-30 cm. long, 3-6 mm. broad; sheaths rounded, sub-carinate at the top, narrow, striate, very glabrous; nodes with spreading or deflexed hairs; ligules oblong,

2-4 mm. long, obtuse, membranous, decurrent into the sheaths, glabrous.

Spiciform racemes solitary or 2-4-nate, sometimes 8-15, sub-digitate and panicled, almost equal, slender straight or flexuous, often nodding, 3-6 cm. long, soft, whitish, green or streaked with violet, sometimes branchy; common axis very glabrous, nodes bearded, alternate or opposite, peduncle very glabrous 4-10 mm. long; rhachis of the racemes many jointed; joints of the rhachis and pedicels 1.5-2.5 mm. long, linear-filiform, back flat, without a longitudinal furrow, hairy on both sides, with a fascicle of short hairs at the base; articulations oblique, without appendage. *Sessile spikelets* hermaphrodite, 3-5 mm. long, ovate-oblong or oblong-concave, compressed, dorsally awned (lower different from the upper). *Lower glume* papyraceous, ovate-oblong or oblong, obtuse or hardly truncate, margins narrowly keeled or inflexed, compressed dorsally, keel spinulosely ciliate, the rest with scattered spreading hairs or glabrous, 5-9-nerved, (nerves evanescent below the top) narrowly clasping the upper glume. *Upper glume* 3-5 mm. long, narrow, lanceolate, slightly acute or obtuse, muticous, 3-keeled, depressed towards the central keel, 3-nerved, smooth except at the base, glabrous or ciliolate. *Lower floret* barren; lemma 2.8-3.3 mm. long, hyaline, linear-oblong, obtuse, nerveless, glabrous. *Upper floret* hermaphrodite; lemma 2.8-3.3 mm. long, rather thick, very narrow, entire; awn 16-24 mm. long, slender, column chesnut, scabrous, more or less distinctly kneeled. *Stamens* 3; 1.75 mm. long. *Ovary* glabrous. *Caryopsis* obovate oblong, compressed, flat on the ventral surface, convex dorsally. *Pedicelled spikelets* male or neuter, equalling or exceeding the sessile but rather more flattened; lower glume obtuse or acute, margin ciliate, 7-11-nerved; upper glume equalling the lower, narrower, lanceolate, obtuse, 3-nerved, ciliate. *Lower floret*; lemma very obtuse, ciliate, 2.75 mm. long. *Upper floret*; lemma small or almost absent, muticous; in the neuter spikelets the lemma smaller.

Considered to be an excellent desert fodder in Africa. Common in the plains and foothills.

21. ARTHRAXON P. Beauv.

Spikes solitary at each node of the rhachis or 2-nate, one pedicelled, muticous, rarely developed and male, often neuter, sometimes reduced to the pedicel, more or less aborted, the other sessile, 2-flowered, hermaphrodite, very often awned, often laterally compressed, finally falling with the contiguous joint of the rhachis. *Lower glume* large, with infolded margins or not, often mucronate, tubercular, muticous, not embracing the upper glume. *Upper glume* narrow, lanceolate, keeled, muticous or mucronate, 3-nerved. *Lower floret* neuter; lemma hyaline. *Upper floret* hermaphrodite; lemma shorter than that of the lower floret and firm at the base, entire or 2-toothed; an awn arises from the dorsal surface just above the base; awn slender, often perfect, sometimes reduced to a mucro; palea small or absent. *Lodicules* 2, small, truncate, cuneiform. *Stamens* 1-3. *Styles* short or absent; stigmas longer than the styles, exserted towards the base of the spikelet. *Caryopsis* narrowly linear or fusiform, rounded, a little obtuse; embryo half the length of the caryopsis.

Slender herbs, often branched. *Culms* decumbent. *Leaves* large, sometimes short, cordate-amplexicaul or ovate-lanceolate. *Inflorescence* of two to many racemes, digitate, fasciculate or sub-panicked at the top of the culm and of its branches. *Rhachis* very slender, fragile at the articulations.

Key to the species of *Arthraxon*.

Stamens 3 :—

Pedicelled spikelets male; sessile spikelets more or less dorsally compressed :—

Perennial with ovate, densely tomentose innovation buds.

1. *A. lanceolatus*.

Annual with slender, prostrate or ascending rooting bases.

2. *A. echinatus*.

Pedicelled spikelets quite suppressed, pedicels present :—

Anthers about as long as the spikelet :—

Common peduncle pubescent.

3. *A. rufis*.

Common peduncle glabrous.

4. *A. breviaristatus*.

Anthers minute, rhachis capillary, sparsely hairy.

5. *A. nudus*.

Stamens 2 :—

Pedicelled spikelets suppressed, pedicels more or less reduced or almost completely suppressed.

6. *A. hispidus.*

Pedicelled spikelets usually present at upper nodes of the racemes, sometimes at lower, neuter, usually much reduced, pedicels distinctly developed, like the joints conspicuously ciliate; lower glume 2-dentate. . . .

7. *A. lancifolius.*

1. Arthraxon lanceolatus Hochst., Flora (1856) 188.
Syn. *Andropogon lanceolatus* Roxb., Flor. Ind. I. 257.

A perennial grass. *Rhizome* at the time of flowering with ovate buds densely covered with fulvous hair. *Culms* 40-80 cm. high, slender, decumbent, creeping, rooting at the lower nodes, very glabrous or scaberulous on the lower nodes, shortly bare at the top, flowering branches solitary or 2-nate, or sub-fastigiate, rarely simple. *Leaf-blades* ovate-lanceolate to linear-lanceolate, up to 9 cm. long by 5-15 mm. broad, green or glaucous, thin or firm, spinulose along the margins; base cordate amplexicaul, many nerved, slender; sheaths rather lax, striate, glabrous or hirsute with tubercle-based hairs; outer margins often ciliate smooth or rough; ligule up to 3.5 mm. long, decurrent into the sheath, membranous, glabrous or ciliate.

Racemes few or many, 1.5-5 cm. long, rhachis sparsely hairy, joints about half as long as the spikelets, margins ciliate. *Sessile spikelets* linear-lanceolate, 6-7 mm. long, with a shortly puberulous callus. *Lower glume* coriaceous-chartaceous, attenuate from the middle, acute, with the apex entire or minutely 2-toothed, 5-7-nerved; dorsal surface convex, sometimes glabrous, sometimes muriculate. *Upper glume* lanceolate, acuminate or mucronulate, 3-nerved, glabrous or ciliate. *Lower floret*; lemma linear-oblong, acute, glabrous. *Upper floret*; lemma hyaline, awn from the base up to 2.6 cm. long or less. *Stigmas* broadly oblong, 2.5-3 mm. long, much longer than the styles. *Pedicelled spikelets* linear-lanceolate, keels hispidulous, male; stamens 3; anthers 2.5-3 mm. long.

In a manuscript Stapf distinguishes 2 varieties of this plant.

- A. Blades ovate-lanceolate, glaucous, firm, ratio of length to breadth mostly 4-3:1 rarely 5:1.
- B. Blades lanceolate to linear-lanceolate, green rather thin, ratio of length to breadth mostly 7-8:1 rarely 5:1 or up to 15:1.
He called the latter var. *angustus*.

2. Arthraxon echinatus Hochst. in Flora (1856) 188.

An annual grass. *Culms* slender up to 30 cm. tall, branched. *Leaf-blades* linear or oblong-lanceolate, up to 6 cm. long, 1.5-1.25 cm. wide, usually pubescent, often ciliate on the rounded base, flaccid; sheaths striate, sparsely hairy; ligule short.

Racemes just emerging from the spatheate sheath, very pale, 1.8-1.25 cm. long; joints and pedicels 2.5 mm. long, ciliate. *Spikelets* geminate, one sessile, one pedicelled, 5 mm. long or a little longer. *Sessile spikelet* 5 mm. long; lower glume as long as the spikelet; nerves on the back of the glume echinulate; lower spikelets rarely smooth; upper glume keeled, scabrid near the top, 3-nerved. *Lower floret* neuter; lemma shorter than the glumes, hyaline. *Upper floret* hermaphrodite; lemma 3 mm. long; awned just above the base; awn 6-8 mm. long. *Anthers* half as long as the lemma.

KHASI and NACA HILLS. 4-7,000 ft.

3. Arthraxon rudis Hochst. in Flora (1856) 188.

A perennial grass. *Culms* 1.7-1.1 m. tall, rigid, erect, geniculate at the base, rooting, branchy, slender, pubescent above, striate, often with flowering branches at the basal nodes; nodes glabrous. *Leaf-blades* oblong-lanceolate, or ovate-lanceolate, with a cordate amplexicaul base, acuminate, 6-10 cm. long, 8-18 mm. broad, spaced, thin, scabrid, pubescent or glabrous below; margins scabrid, sometimes pectinate scabrid, ciliate or spinulose towards the base; median nerve slender, scabrid below; sheaths somewhat lax, with tubercle-based hairs at the summit only; throat shortly auricled; ligules membranous, rounded, fringed, 1-2 mm. long.

The peduncle of the inflorescence is exserted, densely whitish pubescent; racemes 2-8, 1.25-2.5 cm. long, the lower branched, the upper simple, seated on peduncles which are

pubescent, from 5-2 cm. long; rhachis very slender, fragile; joints shortly ciliate. 4-6 mm. long. *Sessile spikelets* somewhat distant, in profile sub-obliquely lanceolate, or almost ovate-lanceolate, 6-8 mm. long, glabrous save on the callus, of a livid green, then brownish; callus very short, with dense hairs 1 mm. long. *Lower glume* coriaceous, very shortly hyaline at the top, broadly lanceolate, very attenuate in the upper two-thirds, acuminate, entire, margins narrowly inflexed, 7-nerved, all the nerves, or only the marginal with tubercular spines. *Upper glume* 6-8 mm. long, coriaceous, papyraceous, top hyaline, acute, keel scabrid or aculeolate, 3-nerved. *Lower floret*; lemma 4-5-6 mm. long, lanceolate, acute, ciliolate, margins infolded, 3-nerved. *Upper floret*; lemma hyaline at the apex, membranous at the base, oblong, entire or bifid at the top; awn sub-basal, 10-14 mm. long; palea very short, hyaline, ovate, top dentate, ciliate. *Stamens* 3; anthers 1.5-2.5 mm. long. *Stigmas* 1.5 mm. long, equalling the styles. *Pedicelled spikelets* absent; pedicel 1/3 the length of the sessile spikelet, acute, sparsely ciliate.

Not common; plains to 3,000 ft.

Mr. V. Narayanaswami, Botanical Survey of India, has drawn my attention to the fact that Hooker's description of *Arthraxon rufid* Hochst. in F.B.I. VII (1897) 144 is to a large extent taken from Griffith's description of *Andropogon castratus* Griff. in Not. III, (1851) 89, and that he refers to this plant in his synonymy and also to Wallichian sheet No. 8837. This latter sheet is undoubtedly the *Arthraxon rufid* of Hochstetter who, incidentally, also refers to this sheet in Flora (1856) 188. It is not known to me if Griffith's sheet is in existence but the description of *Andropogon castratus* Griff. was published in 1852 and so the epithet "castratus" has priority over "rufid" (1856). Mr. Narayanaswami has made the new combination *Arthraxon castratus* (Griff.) Narayanaswami in MSS.

4. *Arthraxon breviaristatus* Hack., Mon. Androp. (1889) 350.

A perennial grass. *Culms* ascending from a decumbent rooting and branched base, 5-1 m. tall, rooting at the nodes, slender, very smooth, short noded below, terete, smooth and glabrous. *Leaves* ovate or broadly ovate-lanceolate, with a cordate amplexicaul base, 2-5 cm. long, 10-12 mm. broad, tip acuminate, with a few evanescent hairs with tubercular

bases at the throat; sheaths somewhat lax with long cilia from tubercle bases in the throat, striate, with scattered tubercle-based hairs at the top; margins densely ciliate with stiff hairs; nodes bearded or not; ligules a narrow membranous ring, convex upwards, densely ciliate.

Peduncle of the *inflorescence* long exserted; racemes 6-10, shortly peduncled, 3-7 cm. long, glabrous, violet-mauve; joints of the rhachis with a straight disarticulation, angled, minutely scabrid, shortly ciliate or glabrous below and ciliate above. *Sessile spikelets* ovate-lanceolate, 4·5-5·5 mm. long, callus glabrous. *Lower glume* papyraceous, oblong-lanceolate, sub-acute, convex, margins not inflexed, 7-9-nerved, long spiny towards the margins; short spines in the middle and at the base, tubercular at the base. *Upper glume* 4-5 mm. long, almost papyraceous, linear-acute, or mucronate; keel acute, ciliate, 3-nerved; margins hyaline ciliolate. *Lower floret*; lemma 3·3-3·5 mm. long, linear-obtuse, glabrous. *Upper floret*; lemma 4·25-5·25 mm. long; awn almost basal, 6-8 mm. long, shortly exserted. *Stamens* 3 rarely 2. *Anthers* 3 mm. long. *Stigmas* 3 mm., twice as long as the styles.

5. *Arthraxon nudus* Hochst. in Flora (1856) 188.

An annual grass. *Culms* 30-60 cm. tall from a prostrate, widely rambling and rooting base, lower nodes sending down many fibrous roots, rarely all the nodes flower bearing, smooth, and glabrous. *Leaf-blades* ovate-acuminate, base cordate amplexicaul, firm or rather flaccid in shady places, smooth above and rough below, midrib rather prominent on the lower surface often with a few spaced hairs, margins scarcely thickened, long ciliate from tubercle bases, 3-8 cm. long, 5-2 cm. broad; sheaths terete, smooth, striate, or with hirsute tubercle-based hairs especially towards the collar, outer margin ciliate; ligules 2 mm. long, membranous, decurrent into the sheaths.

Racemes many, shortly exserted or spathaceously sheathed. *Spikelets* linear-lanceolate in profile, very slightly oblique, 3 mm. long; callus naked; rudimentary pedicels only half the length of the sessile spikelet; joints of the racemes and pedicels glabrous. *Lower glume* lanceolate, 7-

10-nerved, without muriculations except on the outer nerves. *Upper glume* papyraceous, membranous, compressed, scabrid on the upper 1/3 of the keel, 3-nerved. *Lower floret*; lemma lanceolate hyaline, 2 mm. long. *Upper floret*; lemma 2 mm. long, lanceolate, hyaline, glabrous, awned from near the base; awn 8 mm. long. *Pedicelled spikelets* missing, pedicel 1.5 mm. long.

6. Arthraxon hispidus. (*Thunb.*) *Makino* in Bot. Mag. Tokyo XXVI (1912) 214. A *ciliaris* P. Beauv., Agrost. (1812) 111 (in part). Based on *Phalaris hispida* Thunb., Flor. Jap. (1784) 44.

An annual. *Culms* densely tufted, creeping and rambling over the ground, finally ascending, short or tall, leafy to the panicle. *Leaves* ovate or lanceolate, acute or acuminate, rigid or flaccid in shade, sparsely hairy on both surfaces with short white hairs from inbercile-bases, distantly ciliate on the rounded margins at the base; sheaths glabrous, smooth, striate, ciliate on one margin, rather loose or inflated; ligules ciliate, membranous, lacerate, 1 mm. long.

The inflorescence emerges from the sheath of the uppermost leaf which is furnished with a rudimentary blade, and consists of several spikes 2.5-3 cm. long; pedicels completely suppressed or reduced to a mere point; joints of the rhachis 2.5 mm. long, ciliate, curved. *Spikelets* solitary on the nodes of the rhachis, 3 mm. long, dimidiate-lanceolate. *Lower glume* 3 mm. long, convex on the back, very scabrid, especially towards the apex. *Upper glume* keeled, scabrid towards the top. *Lower floret* empty; lemma usually absent. *Upper floret* hermaphrodite; lemma 2 mm. long; awn from the base of the lemma up to 9 mm. long. *Stamens* 2; anthers minute .75 mm. long, purple.

KHASI HILLS, 2,500 ft.

7. Arthraxon lancifolius Hochst. in Flora (1856) 188. Syn. *Arthraxon microphyllus* Hochst. in Flora (1856) 188.

An annual. *Culms* 10-40 cm. tall, very slender, decumbent at the base, then ascending, multi-noded, terete, puberu-

lous below the inflorescence; upper branches very slender, long. *Leaf-blades* lanceolate with a cordate, amplexicaul base, slightly acuminate, green, spreading, 1·5-3 cm. long, 6-9 mm. wide, the older flat, soft, softly hairy, margins with tubercle-based cilia; median nerve slender; sheaths striate, terete, shorter than the internodes; ligules 1-2 mm. long, rounded, truncate, membranous, ciliate.

Inflorescence; common axis very slender, long exserted; false spikes 2-10, soft, densely flowered, unequal, 1·7-1·4 cm. long; joints 1-1·75 mm. long, filiform, ciliate on both sides, cilia often longer than the joints, articulation straight, not appendaged. *Sessile spikelets* 2·5-3·5 mm. long, straight, linear-lanceolate, almost compressed laterally. *Lower glume* membranous, lanceolate or linear-oblong, narrowed towards the base, very acute, margins not inturned, two-toothed or two-aristate, 5-7-nerved, very scabrid at the top. *Upper glume* membranous, lanceolate acute, ending in silky hairs 5-8 mm. long, often spreading, 1-nerved. *Lower floret*; lemma 1·1-1·75 mm. long, lanceolate, acute, glabrous. *Upper floret*; lemma 1·1-1·75 mm. long, linear-oblong, obtuse, glabrous, 2-nerved, close and separated by a deep depression (groove), slightly and obscurely 2-toothed; awn 5-10 mm. long, column hidden behind the glumes or exserted. *Stamens* 2; anthers 1-4 mm. long. *Stigmas* small, equalling the styles in length. *Pedicelled spikelet* 2 mm. long, ciliate, ovate-lanceolate, empty; pedicel 1 mm. long.

A common gregarious grass in wet places in the hills above 5,000 ft. Small forms with one raceme are found on Japvo, Naga Hills, at 9,000 ft.

22. ANDROPOGON Linn.

Spikelets 2-nate, those of each pair differing in sex, and mostly also in shape and size, one sessile the other pedicelled on the articulate, fragile rhachis of many jointed, paired or digitate racemes terminating the culms; raceme pairs supported by a spathe or spatheole and frequently collected into a false panicle; the sessile spikelet falling with the contiguous joint and accompanying pedicel; joint and pedicels filiform or thickened upwards (rarely stout) and then the top frequently more or less cupular or auricled. *Florets*

2, lower reduced to an empty lemma, upper hermaphrodite in the sessile spikelets, male, neuter, or suppressed in the pedicelled spikelets. *Sessile spikelets* dorsally or laterally compressed, nearly always awned; callus short, mostly quite obtuse, shortly bearded. *Glumes* equal or sub-equal, sub-coriaceous to membranous, the lower flat or concave or channelled on the back with, at least from the middle upwards, sharply inflexed margins, 2-keeled, the upper more or less boat-shaped, keeled upwards, 3-1-nerved, sometimes aristate. *Lemmas* ciliate or ciliolate, rarely glabrous, of lower floret hyaline, 2-nerved, of upper 2-fid or 2-dentate, hyaline or firmer and sometimes sub-stipitiform below the insertion of the awn. *Palea* a hyaline nerveless scale or absent. *Lodicules* 2, minute, glabrous. *Stamens* 3. *Stigmas* laterally exserted; styles terminal. *Caryopsis* narrowly oblong to lanceolate, sub-terete, to plano-convex; embryo about the length of the grain. *Pedicelled spikelets* often very different from the sessile in shape, and less so in size, always more or less compressed dorsally, nerves concave, or channelled on the back, sometimes reduced and then often small or quite suppressed.

Mostly perennial grasses of varying habit; not aromatic.

Key to the species of Andropogon.

Inflorescence of paired racemes. ..	..	1. <i>A. ascinodis.</i>
Inflorescence of fascicled racemes. ..	..	2. <i>A. munroi.</i>

1. Andropogon ascinodis C. B. Clarke in Linn. Soc. Jour. XXV (1889) 87. Syn. *A. apicus* Hook. f. in F. B. I. VII (1897) 169; non Trin.

A perennial grass. *Culms* 50-200 cm. tall, erect, slender, terete, very smooth, branched. *Leaf-blades* linear, setaceous-acuminate, 10-90 cm. long, 1-4 mm. broad, erect, coriaceous, flat or rolled when dry, finally reddish, glabrous, pubescent towards the base, scabrid at least above; median nerve white above, rather thick below; sheaths rounded, smooth, narrow, very slender, setaceous at the top, then sub-spathiform; ligules papyraceous, truncate, glabrous, 1-2.5 mm. long.

Inflorescence a false panicle; proper spathes green,

lanceolate, often ending in a short limb; spiciform racemes 2·5, 1·5-2·5 cm. long, hispid, very unequal in each fascicle, shortly pedicelled, more or less elongated from the spathe, with rigid cilia; rhachis fragile, joints and pedicels 3·5 mm. long, sessile; joints broadly cuneiform in outline, base narrow, rounded on the back, without a groove, glabrous or scabrous, with large white hairs (3-4 mm. long) which are absent at the top and on the articulation; articulation an oblique cup. *Sessile spikelets* compressed laterally, oblong in profile, pale, 5 mm. long, all hermaphrodite, rarely female, very rarely neuter. *Lower glume* membranous, linear, truncate, margins broadly inflexed and two-keeled, with a depressed furrow between the thick and scabrid keels, glabrous, 5-9-nerved; callus 1 mm. long, acute, silkily bearded. *Upper glume* 5 mm. long, keeled, compressed, obovate-oblong, obtuse, entire at the top and carrying an awn 10-15 mm. long, 1-nerved, keel scabrid, margins ciliate. *Lower floret*; lemma 4-5 mm. long, linear-oblong, 2-nerved, 2-keeled, ciliolate. *Upper floret*; lemma 3·5-3·75 mm. long, obovate, membranous, back gibbous, 3-nerved, ciliate below the top, shortly 2-toothed, teeth ciliate (sparsely); awns robust, 25-30 mm. long, long exserted; palea 3·3-3·6 mm. long, linear-oblong, nerveless. *Pedicelled spikelets* neuter, equaling the sessile or shorter, narrower, pale or purplish, lanceolate-oblong; lower glume herbaceous, membranous, ovate-lanceolate or oblong, bicuspidate, acute, keel ciliate principally at the top; awn twice as long as the spikelet; upper glume the same length as the lower, membranous, 3-nerved, glabrous, shortly aristate. *Upper* and *lower florets* small or absent. *Stamens* absent. The *sessile spikelets* at the base of the racemes often neuter and rudimentary; anthers 2 mm. long, linear, brown.

Very common, KHASI and JAINTIA HILLS, 3-4,000 ft. NAGA HILLS 6-8,000 ft.

2. *Andropogon munroi* C. B. Clarke in Journ. Linn. Soc. XXV (1839) 87. t. 37.

A perennial grass. *Culms* tall, slender, 60-100 cm. tall, simple or sparingly branched upwards, terete or slightly

compressed, nodes glabrous. *Leaf-blades* 15-25 cm. long by 2.5 mm. broad, rather coriaceous, smooth, glabrous, nerves close set, glaucous beneath, midrib prominent; sheaths rather lax, striate, smooth and glabrous, somewhat compressed or keeled; ligule membranous, glabrous, truncate, erose, 2 mm. long or more.

Panicle 2.5-3 cm. long, as broad as long, of a few irregularly spreading branches; spathe 2.5-7 cm. long, very slender, terete, acuminate. *Racemes* 4-8, 6-18 mm. long, shortly stipitate, solitary or 2-3-nate, divaricate or drooping; peduncle and pedicels of racemes smooth, silkily ciliate; joints and pedicels or upper spikelets with irregularly toothed cupular tips; lowest pair of spikelets sometimes imperfect or male. *Spikelets* 4-6 pairs, 4.25 mm. long, laxly imbricating; callus softly bearded. *Sessile spikelet*; lower glume coriaceous, glabrous, shining, margins incurved, keels minutely scabrous, nerves 0, or 1 vanishing below the middle; upper glume acuminate, 3-nerved, ciliolate above the middle, awned or not, usually unawned. *Lower floret*; lemma hyaline, ovate-oblong, 2-nerved, glabrous. *Upper floret*; lemma as long as the lower lemma, lobes subulate; awn 6-16 mm. long, capillary; palea minute, truncate. *Pedicelled spikelets* male; lower glume linear-oblong, convex, sub-acute, 7-9-nerved; upper glume acuminate, 3-nerved, glabrous; lower floret as in the sessile spikelet; upper floret; lemma lanceolate.

Pulebadze, Naga Hills 7,900 ft.

23. CYMBOPOGON Spreng.

Spikelets 2-nate, those of each pair differing in sex and more or less in shape, except those of the lowest pairs of the lower, or of both racemes, which are homogamous (male or neuter) : one sessile, the other pedicelled, on the articulate, fragile rhachis of many-jointed, paired racemes, terminating the culms and their branches; raceme-pairs supported by a spatheole, collected in often decompound or supra-decompund, spatheate panicles; the fertile spikelets falling with the contiguous joint and the accompanying pedicel; joints and pedicels filiform or linear with frequently more or less

cupular or auricled tips, those of the lowest pair (raceme base) often conspicuously swollen, oblong or barrel-shaped and hard. *Florets* 2, lower reduced to an empty lemma, upper hermaphrodite in the sessile spikelets of the heterogamous pairs, male, rarely neuter, in those of the homogamous pairs and in the pedicelled spikelets. *Fertile spikelets* dorsally, rarely laterally, compressed, awned (normally); callus very short, obtuse, shortly bearded. *Glumes* equal or sub-equal, more or less chartaceous, the lower almost flat or slightly depressed or narrowly grooved on the back with, at least from the middle upwards, sharply inflexed margins, 2-keeled, the upper more or less boat-shaped, keeled upwards, usually 1-nerved. *Lemma* ciliate or ciliolate, (sometimes obscurely) of the lower floret entire, hyaline, 2-nerved, of the upper floret 2-fid or 2-lobed, hyaline, rarely firmer and almost stipe-like below the insertion of the awn; column of awn, if any, smooth. *Palea* absent. *Lodicules* 2, minute, glabrous. *Stamens* 3. *Stigmas* laterally exserted; styles terminal. *Caryopsis* oblong in outline, sub-terete or plano-convex in cross section; embryo almost half the length of the grain. *Pedicelled spikelets* usually slightly different in shape and size from the sessile, but never depressed or grooved on the back. *Glumes* muticous the lower chartaceous to sub-chartaceous, the upper thinner, of the lemmas only that of the lower floret present, hyaline, 2-nerved; upper floret usually represented by a naked male flower, rarely suppressed.

Perennial, densely tufted and usually aromatic grasses, with often very coarse leaves, and frequently much compound and contracted, spatheate panicles.

Key to the species of *Cymbopogon*.

Lower glume of sessile spikelet with a narrow groove from the middle downwards; leaf-blades flat; rounded or contracted at the base:—

Perennial; pedicelled spikelets glabrous. . . . 1. *C. martini*.

Annual, pedicelled spikelets minutely hairy. 2. *C. clandestinus*.
Lower glume of sessile spikelet flat on the back or concave between the keels; leaf-blades narrowed downwards:—

Sessile spikelet awnless :—

Lower glume of sessile spikelet linear to linear-lanceolate, 5-6 mm. long, concave between the keels, wingless.

3. *C. citratus*.

Lower glume oblong to oblong-lanceolate, flat or nearly so on the back, 4-4.5 mm. long, narrowly winged above middle.

4. *C. nardus*.

Sessile spikelet awned :—

Inflorescence rather loose, not conspicuously villous; hairs not hiding the sessile spikelet; awn well-developed, geniculate :—

Leaf-sheaths compressed and keeled; culms compressed, lower glume with a deep channel between the raised indurated keels, minutely pubescent in the channel.

5. *C. hookeri*.

Leaf-sheaths and culms terete, lower glume flat on the back or depressed or grooved towards the base; glabrous between the keels :—

Sessile spikelets 5-6 mm. long; awn about 10 mm. long; racemes 2-2.5 cm. long :—

Lower glume linear-lanceolate, shallowly grooved or rarely flat, furrow above middle downwards, almost wingless, nerves inconspicuous.

6. *C. pendulus*.

Lower glume elliptic or oblong-elliptic, shallowly concave below the middle narrowly winged; nerves conspicuous.

7. *C. khasianus*.

Sessile spikelet 3-5 mm. long, awns up to 7 mm.; racemes 1.5-2 cm. long.

8. *C. exsertus*.

Inflorescence contracted, dense, rather narrow; hairs long and more or less concealing the sessile spikelets; awn usually straight and short; basal leaves very narrow.

9. *C. jwarancusa*.

1. *Cymbopogon martini* Watson in Atkins., Gazetteer N. W. Prov. India (1882) 392. Syn. *Andropogon martini* Roxb., Flor. Ind. I. (1820) 280.

A perennial aromatic grass. *Culms* erect, smooth, 90 cm. to over 1.8 m. tall, simple or sparingly branched, knotty at the base when old; base covered with dry sheaths. *Leaf-blades* almost lanceolate, or linear-lanceolate, cordate, round-

ed at the base, sub-amplexicaul, acuminate, flat, 25-40 cm. long, 1-3 cm. broad, green above, glaucous or pruinose below, very glabrous, with scabrid margins, rarely with scabrid surfaces; median nerve rather thick below, a white line above, lateral nerves numerous; sheaths very glabrous, smooth, faintly striate; ligule oblong scarious, 2-3 mm. long.

Inflorescence a false decomound panicle, linear-oblong, reddish at maturity, dense but often interrupted at the base; branches almost erect; the lower primary several noded, sub-flexuous, with nodes close together, the secondary basal, 2-3-nate, often only one, rarely 3-4-noded, all more or less crowded. True spathes sheath-like, three times longer than the common peduncle. *Spiciform racemes* epinastic at maturity, unequal, one sessile with a pair of homogamous spikelets at the base, 3-4-jointed, the other with the spikelets all heterogamous, 4-6-jointed, the homogamous pairs persisting at the top of the peduncle after the fall of the other spikelets; joints and pedicels 2 mm. long, linear-sub-claviform, rather thick, convex on the back, with a line of long hairs; margins bearded, articulations with a irregularly toothed appendage. *Sessile spikelets* hermaphrodite, ovate or ovate-oblong, flattened on the back. *Lower glume* oblong or ovate-oblong, obtuse, papyraceous, apex obtuse, often emarginate, or obscurely bilobed, with margins keeled and inturned, keels membranously winged at the top, with the back deeply and narrowly channelled, 2-nerved towards the top or without nerves apart from those of the keels; callus obtuse, obscurely keeled. *Upper glume* 4 mm. long, papyraceous, lanceolate-acute, margins ciliate, infolded, with a keel which is winged, serrulate above the middle, 3-nerved, ciliate. *Lower floret*; lemma 3.5 mm. long, oblong-obtuse, nerveless, ciliate. *Upper floret* hermaphrodite; lemma small, lobed at the summit or just to the middle, divided into filiform fimbriae, glabrous or ciliate, with an awn which is often perfect; palea often absent. *Stamens* 3; anthers 1.5-2 mm. long. *Pedicelled spikelets* male, 4 mm. long, lanceolate-oblong, obtuse or rarely acute; upper floret missing; lower glume flat, muticous, 7-9-nerved, glabrous with

ciliate keels; upper glume lanceolate acute, 3-nerved, with a ciliate keel. *Lower floret*; lemma oblong, ciliate, 2-nerved.

KHASI and GARO HILLS and doubtless elsewhere.

2. *Cymbopogon clandestinus* Stapf in Bull. Imp. Inst. Lond. XXVII (1929) 458. Syn. *Andropogon schoenanthus* Linn. sub-sp. *clandestinus* Hack., Mon. *Androp.* (1889) 612.

A perennial grass with slender culms, up to 1.75 m. tall, smooth, glabrous and polished, terete; nodes glabrous. Leaf-blades linear, tapering above to a point, up to 50 cm. long, 6 mm. wide, rough on both surfaces; ligule a lacerate membrane, convex upwards, up to 2 mm. long.

Inflorescence an interrupted panicle 10-30 cm. long, nodding, made up of many, finally epinastic raceme-pairs issuing from spatheoles. *Racemes* 1.5-2.5 cm. long, one sessile the other shortly peduncled. *Spatheole* up to 4 cm. long, ovate-lanceolate, striate with scarious margins, long-acuminate; peduncle of the racemes 10 mm. long, smooth and glabrous, dilated at the top. Lowest pair of spikelets in one raceme homogamous, male or neuter, resembling the pedicelled spikelets, 4.5-5 mm. long; lowest joint of the raceme swollen, glabrous; pedicel of pedicelled homogamous spikelet inflated. *Sessile spikelets* 4 mm. long; lower glume as long as the spikelet, 2-toothed, narrowly winged above the middle; margins incurved, nerves obscure; upper glume boat-shaped, smooth and glabrous, as long as the spikelet. *Lower floret* neuter; lemma narrowly oblong, hyaline. *Upper floret* hermaphrodite; lemma hardly broader than the base of the awn, cleft into 2 subulate lobes; awn up to 15 mm. long. *Pedicelled spikelets* 4-6 mm. long, seated on clavate pedicels which are half the length of the sessile spikelets and ciliate with white hairs. *Lower glume* lanceolate in shape, 6 mm. long, minutely pubescent on back and sides, many-nerved; nerves prominent; upper glume somewhat shorter, 3-nerved, minutely pubescent or not. *Lemmas* absent or occasionally one present.

NAGA HILLS on the Burma frontier, 2,000 ft.

3. *Cymbopogon citratus* Stapf in Kew Bull. (1906) 357. Syn. *Andropogon schoenanthus* Linn., Syst. ed. X (1759) 1304, not of Sp. Pl.

A tall perennial, throwing up dense fascicles of leaves from a short, oblique, annulate, sparingly branched rhizome, usually barren but occasionally giving rise to stout, erect culms up to over 2 m. in height, glabrous, smooth, lowest internodes up to 30 cm. long. *Leaf-blades* linear, long-attenuate towards the base, tapering to a setaceous point, up to 1 m. long by 6-18 mm. wide, firm, glabrous, green, scabrid on the margins; sheaths terete, sub-coriaceous, quite glabrous and smooth; ligules very short, scarious, rounded or truncate.

Panicle spatheate, decompound, loose, 30-60 cm. long, nodding, spathes narrow lanceolate, acute or acuminate; spatheoles very narrow, linear-lanceolate to almost subulate, reddish; peduncles 6-10 mm. long, glabrous. *Racemes* 2-nate, finally spreading at right angles and epinastically deflexed, moderately dense, 14-25 mm. long, pale, variously tinged with dull purple, loosely villous, one sessile the other with a slender base, 2 mm. long and hairy; the pedicels of the homogamous pair also slender though short; fertile joints filiform, 2-3 mm. long, ciliate on both sides; cilia increasing upwards to more than 2 mm. long; tips obliquely auriculate and cupular; adjacent pedicels similar. One pair of homogamous spikelets at the base of the sessile raceme. *Fertile spikelets* linear or linear-lanceolate, acutely acuminate, 5-6 mm. long, reddish, glabrous; callus short obtuse, minutely bearded. *Glumes* sub-equal; lower sub-chartaceous, slightly depressed towards the base, otherwise flat on the back, keels acute, scaberulous above; intracarinal nerves 0 or 1, short and indistinct. *Upper glume* boat-shaped, slightly curved on the back, acute, keeled upwards. *Lower floret* reduced to a hyaline, oblong to almost linear, sub-2-nerved lemma, ciliolate above, slightly shorter than the glumes. *Upper floret* hermaphrodite; lemma narrowly linear, acute, about 4 mm. long, usually entire and awnless, rarely more or less 2-fid with a small bristle from the sinus. *Anthers* 2 mm. long. *Pedicelled spikelets* male or neuter, linear to subulate-lanceolate, as long

as the sessile, reddish, glabrous; lower glume 5-9-nerved, upper 3-nerved; lemma shorter to much shorter than the glumes, hyaline, ciliolate; of upper floret very narrowly linear, if present at all.

Occasionally cultivated.

4. ***Cymbopogon nardus* Rendle** in Cat. Welw. Afr. Pl. II (1899) 155. Syn. *Andropogon nardus* Linn., Sp. Pl. (1753) 1046.

An aromatic cæspitose perennial grass. Culms 1-1·5 m. tall, erect, or with a geniculate base, ascending, growing in thick tufts, more or less surrounded at the base with the firm, persistent sheaths. Leaf-blades flat, rigid, linear, long, setaceous-acuminate, green or glaucescent above, glabrous or with a few hairs at the base, more or less scabrid below, minutely scaberulous or smooth above; margins very scabrid; median nerve rather thick; lateral nerves numerous; sheaths grouped at the base of the culms, narrow, tight, very glabrous, striate; ligule membranous, 1-3 mm. long, rounded, truncate, glabrous, not decurrent at the margins; true spathe narrowly cymbiform, reddish, twice as long as the common peduncle, so equalling the racemes.

Inflorescence a panicle which is pyramidal or linear oblong up to 80 cm. long, lax, decomound, with the branches and branchlets kneeled, with rather distant nodes; spiciform racemes unequal, 8-16 mm. long at first erect then deflexed, one is almost sessile and has a pair of homogamous spikelets close to the base, the other peduncled with all spikelets heterogamous; the homogamous pair sterile, falling very tardily; joints of the rhachis and pedicels linear-filiform, about half the length of the sessile spikelets, glabrescent or pubescent on the back and margins; articulations very shortly cupped and appendaged. *Spikelets* without awns, sometimes mucronate, violet or reddish, the sessile hermaphrodite, 4-4·5 mm. long, lanceolate-acute; lower glume 4-4·5 mm. long, papyraceous, with keels very narrowly winged, entire or 2-toothed at the top, 2-4-nerved between the keels, glabrous; callus very small and shortly bearded; upper glume 4-4·5 mm. long, lanceolate or elliptic, navicular. *Lower floret*; lemma 3·5-4

mm. long, oblong, obtuse, nerveless, ciliate. *Upper floret* hermaphrodite; lemma shorter, linear, divided into 2 short teeth, with a mucro shortly or not exserted. *Pedicelled spikelets* male, 3·8-4 mm. long, lanceolate-acute.

This grass smells of lemon and is only known in cultivation.

5. **Cymbopogon hookeri** Stapf ex Bor, Ind. For. Rec. (Bot.) I. 3 (1933) 92. Syn. *Andropogon hookeri* Munro ex Hack., Mon. Androp. (1889) 614.

A perennial grass, tall, slender, up to 2 m. high. *Culms* terete or compressed below, smooth and glabrous. *Leaf-blades* 30-40 cm. long by 2·5-5 mm. broad, rather rigid, smooth, margins scabrid; midrib broad, keeled below; *leaf-sheaths* remarkable in being keeled and compressed, very glabrous and smooth, striate; ligules obtuse, membranous, glabrous.

Panicle small for the genus, linear, interrupted, 30-40 cm. long, primary branches of 1 or 2 nodes giving off solitary secondary branches, sub-erect. *Racemes* sub-equal; joints and pedicels dorsally glabrous; margins sparsely villous, tips 2-3-lobed. *Spatheoles* 1·7-3 cm. long; joints and pedicels or racemes stout, clavate, with stout hairs on both sides. *Sessile spikelets* 6 mm. long; callus short obtuse, minutely bearded; spikelets dorsally concave and puberulous, keels scabrid; lower glume coriaceous-chartaceous, acute, minutely 2-toothed, keels not margined or winged obscurely 2-nerved; upper lanceolate, acute, keel scabrid, margins eciliate. *Lower floret*; lemma as long as the spikelet, hyaline, margins inflexed ciliate. *Upper floret* hermaphrodite; lemma 2-cleft, lobes slender, eciliate; awn nearly 2 cm. long. *Pedicelled spikelets* equalling the sessile, linear-lanceolate, glabrous.

AKA HILLS.

6. **Cymbopogon pendulus** Watson in Atkins., Gazeteer N. W. Prov. Ind. (1882) 392. Syn. *Andropogon pendulus* Nees ex Steud., Syn. Pl. Glum. (1854) 388.

Close to *Cymbopogon nardus* Rendle. *Culms* very tall; leaves up to 1 m. in length, median nerve very thick at the

base; spatheole up to 2 cm. exceeding the common peduncle several times in length.

Inflorescence 30-50 cm. long, oblong, lax, decomound, branched to the third degree, branches equal, with branches and branchlets somewhat nodding, often undulate, rather flexuous, the primary long, slender with rather distant nodes; the secondary 2-nate, 2-4-noded; the tertiary simple. *Racemes* with pairs not crowded, 2-2.5 cm. long, with 4-5 joints with long hairs. *Hermaphrodite spikelets* lanceolate, pale green, 5-6 mm. long, with an awn 9-11 mm. long; lower glume more or less winged (wing narrow), 4-nerved in addition to the carinal nerves, shallowly 2-pitted at the base, rarely without shallow pits. *Male spikelets* violet or reddish at the summit.

Foothills of the Himalaya.

7. *Cymbopogon khasianus* Stapf ex Bor, Ind. For. Rec. (Bot.) I. 3 (1938) 92. Syn. *Andropogon nardus* Linn. var. *khasianus*, Hack., Mon. Androp. (1889) 662.

Perennial. A tall grass up to 2 m. high, base stout, covered with the remains of old sheath-bases; culms erect from the rootstock, smooth and glabrous. Leaves flat, up to 2 cm. wide, smooth and glabrous on the surfaces, firm; margins thickened and serrulately scabrid; blades linear, gradually tapering to a firm setaceous point, rounded at the base; sheaths terete, much shorter than the internodes, striate, smooth and very glabrous; basal sheaths loose, scarious, long persistent; ligules up to 2 mm. long, truncate, membranous.

Panicle elongate, 30-90 cm. long, narrow, contracted or more often loose, compound or decomound, nodding; spathes narrowly lanceolate, 1.8-3 cm. long; spatheoles similar in shape, 1.25-1.8 or even 3 cm. long; racemes; one sessile the other on a short glabrous peduncle, the former shorter than the latter which may be up to 2 cm. long; joints and pedicels about 2.5 mm. long, compressed, short ciliate on both sides, top cupular with an irregular number of tooth-like appendages. Lowest pair of sessile raceme homogamous, all the other pairs of spikelets heterogamous. *Sessile spikelet* 5-5.5 mm. long, elliptic-oblong in shape or ovate-lanceolate without the wings. *Lower glume* ovate-lanceolate

in shape, 2-keeled, the keels broadly winged above the middle, acute or more usually obtuse, back flat or slightly convex or often with two shallow depressions, 7-9-nerved; nerves often conspicuous above the middle; margins narrowly inflexed, ciliate. *Upper glume* ovate-lanceolate, acute, boat-shaped, 3-nerved, margins inturned and long-ciliate. *Lower floret*; lemma hyaline, nerveless, as broad and as long as the upper glume; margins incurved, ciliate. *Upper floret* hermaphrodite; lemma narrow (·5 mm. broad), linear, 3·5-4 mm. long, cleft into two lanceolate, ciliate lobes to below the middle, awn up to 14 mm. long; palea absent. *Stamens* 3, anthers 2 mm. long. *Pedicelled spikelets* male or neuter; lower glume lanceolate when flat or narrowly ovate-lanceolate, sides rounded, margins inturned, hyaline; nerves many, up to 13; upper glume obovate when flat, the upper half of the margins hyaline and very broad ciliate, 3-nerved; lemma similar to the lower lemma of the sessile spikelet. *Anthers* 3, 2 mm. long. *Lodicules* two, cuneate, glabrous.

Very common in the KHASI and NAGA HILLS.

8. *Cymbopogon exsertus* A. Camus in Rev. Bot. Appl. IV. 287. Syn. *Cymbopogon nardus* L. sub-sp. *marginalis* var. *exsertus* Hack., Mon. Androp. (1889) 608.

Culms short, slender. *Leaf-blades* long (up to 1 m.) and narrow, 4-8 mm. wide, rough on both surfaces; margins scabrid; sheaths terete, loose, striate, smooth and glabrous; ligule membranous.

Panicle 30-35 cm. long, very narrow, lax-flowered; branches short, the primary 1-4-noded, erect, strict, upper nodes distant, the secondary solitary, 1-noded. Proper spathes 1·5-2 cm. long, reddish-green. Racemes completely exserted from the spathes, 1·5-2 cm. long, 5-6-jointed; joints densely ciliate. *Spikelets* 4-6 mm. long, lanceolate or linear-lanceolate; lower glume 2-toothed, dorsally flat or shallowly depressed, nerveless, keels hardly margined; lobes of upper lemma broad, densely ciliate; awn 1·25 cm. long.

Plains of the Assam Valley.

9. **Cymbopogon jwarancusa** Schult., Mant. II.
(1824) 458. Syn. *Andropogon jwarancusa* Jones in *Asiat. Res.* IV (1795) 109.

Usually a tall perennial grass, but may be only a few inches high, roots aromatic, densely tufted, the stems with firm, persistent, finally loose and open and tortuous leaf-sheaths, more or less inflated below, 1-2 m. tall. *Leaves* 15-60 cm. long, narrowly linear, tips capillary, filiform at the base, up to 5 mm. wide flat; sheaths glabrous, lower dilated; ligules shortly oblong, membranous, ciliolate.

Panicle usually long, narrow, interrupted, branches distant or crowded, sub-simple or much, loosely or densely, branched; spathes up to 5 cm. with the spatheoles (proper spathes) 1.25-1.8 cm. long, the latter longer than the peduncles of the racemes and narrowly lanceolate. *Racemes* unequal, 6-18 mm. long, spikelets 3-4 pairs, half hidden by the 5 mm. long villae of the joints and pedicels. *Sessile spikelets* 5 mm. long, ovate or linear-lanceolate in shape, lowest pair of the sessile raceme homogamous (neuter) those of the peduncled raceme heterogamous. *Lower glume* 2-keeled, flat or concave between the keels, glabrous, margins narrowly inflexed, keels wingless, nerves 2-4 or 0 between the keels; keels said to be occasionally scabrid, ciliate. *Upper glume* cymbiform as long as the lower glume, 3-nerved, acute, margins narrowly inflexed, hyaline and ciliolate. *Lower floret* neuter; lemma up to 5 mm. long, narrowly lanceolate, 2-nerved. *Upper floret* hermaphrodite; lemma narrow, 2-3 mm. long, cleft at the top, lobes subulate and ciliate, awn 5 mm. long. *Pedicelled spikelets* 5 mm. long; lower glume elliptic-lanceolate, 7-9-nerved, membranous, rounded at the sides, convex or almost flat on the back, margins incurved; upper glume similar in size, texture and shape, 3-nerved, margins hyaline, incurved ciliate; lower floret absent; upper floret; lemma lanceolate, hyaline.

Not common, but has been collected near Goyabari, Kamrup.

24. HYPARRHENIA Anders.

Spikelets 2-nate, those of each pair differing in sex and more or less in shape, or those of the lower pair or pairs homo-

gamous (male or neuter), one sessile and the other pedicelled, on the articulate fragile rhachis of few- to many-jointed paired racemes, terminating the culms and their branches; raceme-pairs supported by a spatheole, collected into scanty or compound to decompound spathate panicles; the fertile spikelets falling with the contiguous joint and the accompanying pedicel; joints and pedicels finely filiform, with more or less obliquely truncate sometimes obscurely auricled tips, in racemes with homogamous spikelets on the joint or joints below the lowest fertile spikelet entering into the formation of the raceme base, shorter to very short, eciliate and tardily disarticulating. *Florets* 2, lowest reduced to an empty lemma, upper hermaphrodite in the sessile spikelets of the heterogamous pairs, male or neuter (rarely quite suppressed) in those of the homogamous pairs and of the pedicelled spikelets. *Fertile spikelets* more or less flattened dorsally but with rounded sides, awned (very rarely awnless); callus short and obtuse or more often acute to pungent, shortly bearded. *Glumes* equal, more or less chartaceous, mostly thin, the lower narrowly truncate or 2-dentate, sometimes with a very shallow longitudinal depression, with very narrow involute margins up to 2/3rds or more, then equally narrowly inflexed from the very fine short or obscure keels, the upper narrowly and shallowly boat-shaped, rounded on the back below, finely keeled towards the tips only, 3-nerved. *Lemma* ciliate or that of the upper floret glabrous, of the lower floret hyaline, 2-nerved (often very faintly), rarely quite nerveless, of the upper stipitiform with a very fine delicate hyaline base, above it gradually hardened with narrow hyaline margins which gradually run out into minute teeth, passing between the teeth into the mostly distinctly kneed, more or less hirtellous or sub-plumose awn. *Palea* absent, rarely a small hyaline scale. *Lodicules* 2, minute, glabrous. *Stamens* 3. *Stigmas* laterally exserted; styles terminal. *Caryopsis* oblong in outline, sub-terete to plano-convex in cross-section: embryo about half the length of the grain. *Pedicelled spikelets* acute, often mucronate or aristulate from the lower glume, usually somewhat longer than the fertile and more distinctly 2-keeled (often below the middle), lemma of both florets developed,

even in neuter spikelets, rarely the upper or both suppressed.

Perennial or annual, mostly coarse grasses with often large, loose, rarely much contracted, panicles; never aromatic.

***Hyparrhenia griffithii* Bor,** Ind. For. Rec. (Bot.) I.
3 (1938) 92.

A perennial grass from a creeping rhizome. *Culms* erect or slightly geniculate, slender, glabrous, up to 2 m. tall, innovations intravaginal, leafy. *Leaves* linear from a rounded contracted base, tapering to a very fine point, up to 40 cm. long, 3 mm. wide, glabrous on both surfaces or covered with soft white hairs when young; median nerve white, prominent; margins minutely scabrid; basal sheaths carinate, persistent, glabrous, upper slipping from the culm, terete, glabrous or with a few white hairs, very hairy when young; margins often ciliate, throat hairy; ligules membranous, convex upwards, up to 2 mm. long.

Inflorescence a compound, spatheate panicle up to 35 cm. long, contracted; branches erect, strict, filiform, issuing from lanceolate to linear, setaceous-acuminately spathes, which are up to 15 cm. long; spatheoles narrow 3-4 mm. wide, linear, convolute, 4-6 cm. long; common peduncle filiform, up to 4.5 cm. long, shorter than the spatheole, glabrous and smooth below, covered in the upper quarter with 4 mm. long white hairs from tubercle-bases, enclosed in the spatheole until anthesis, afterwards emerging. *Racemes* in pairs, epinastic after anthesis, unequally peduncled (longer peduncle 3 mm. long), 2 cm. long; peduncles bearded at the base; joints and pedicels filiform, up to 4 mm. long, flattened, densely ciliate, tip expanded and very oblique. The lowest pair or two lowest pairs of spikelets homogamous, male or neuter; heterogamous spikelets 2-3 pairs, the sessile hermaphrodite, the pedicelled male or neuter; callus acute, bearded. *Homogamous spikelets* ovate-oblong in shape. *Lower glume* 6.5 mm. long, up to 11-nerved, 2-toothed, one-toothed being extended into a short bristle or not; back rounded or flat; nerves with long white hairs. *Upper glume* 6.5 mm., 3-4-nerved, oblong-lanceolate, rounded on the back; margins long,

ciliate. *Lower floret* barren; lemma narrow, 6 mm. long, hyaline, ciliate on the margins. *Upper floret*; lemma ovate-lanceolate, hyaline, margins ciliate at the top; palea minute, sometimes containing a rudimentary ovary and stamens or stamens only, usually empty. *Stamens* if present 3; anthers 4 mm. long. *Sessile spikelets* narrowly elliptic-oblong in shape. *Lower glume* 5·5·5 mm. long, truncate, 2-toothed, back slightly rounded below, flat or shallowly depressed above, 5-9-nerved; margins involute; nerves covered with stiff white hairs up to 4 mm. long. *Upper glume* lanceolate, oblong, sub-acute, 6 mm. long, keeled, depressed on either side of the keel, 1-3-4-nerved, ciliate on the keel and pubescent on the sides at the top. *Lower floret* barren; lemma linear-oblong, 5 mm. long, obtuse, hyaline, ciliate on the margins at the top; palea absent. *Upper floret* hermaphrodite; lemma 4 mm. long, linear, concave, translucent, margins carried out into two subulate teeth, awned; awn slightly narrower than the lemma; column 2 cm. long, dark brown, hispid with rufous upwardly-directed hairs, remainder 2 cm., antrorsely barbed; palea, if present, minute. *Stamens* 3; anthers 2·5 mm. long. *Ovary* ovoid; stigmas 2. *Grain* terete 4 mm. long. *Pedicelled spikelets* barren, narrower, linear-lanceolate in outline. *Lower glume* 9-11-nerved, flat on the back, 2-toothed or one tooth extended into a barbed bristle, 2·5 mm. long. *Upper glume* lanceolate, rounded on the back, 3-nerved. *Lower floret* absent or represented by a very narrow hyaline lemma; palea, if present, minute, truncate. *Upper floret*; lemma hyaline, ovate-lanceolate, ciliate; palea, if present, minute, truncate.

This grass covers large areas in the Synteng country north of NARTIANG, KHASI and JAINTIA HILLS.

Flowers in November-December.

26. SCHIZACHYRIUM Nees.

Spikelets 2-nate, of each pair differing in sex, and mostly also more or less in shape and size, one sessile, the other pedicelled, on the articulate, fragile, rachis of many-jointed, solitary racemes terminating the culms and their branches, supported by spathes and frequently collected into a false

panicle, the sessile spikelets falling with the contiguous joints and the accompanying pedicelled spikelet; joints and pedicels thickened upwards, often rather stout, with a scariosus, cupuliform, more or less dentate, terminal appendage. *Florets* 2, the lower reduced to an empty lemma, upper hermaphrodite in the sessile, male, neuter or absent in the pedicelled spikelets, or both lemmas suppressed in these. *Sessile spikelet* dorsally compressed or sometimes in their lower half almost terete, awned; callus short, with a short beard at the base. *Glumes* equal or sub-equal, lower chartaceous (often thinly- to sub-coriaceous, more or less convex (to sub-terete) or flat on the back, at least from the middle upwards, sharply inflexed and mostly narrow margined, 2-keeled, the keels running out into teeth or mucros; upper thinner to membranous, narrowly boat-shaped to dorsally flattened, keeled (at least upwards) 1-3-nerved, the delicate margins ciliate. *Lemmas* ciliolate, hyaline, of lower floret membranous downwards and often purplish, 2-nerved, of upper usually 2-fid sometimes very deeply, or 2-dentate, rarely entire, awned; awn from the sinus or a continuation of the entire lemma; palea absent or a minute hyaline scale. *Lodicules* 2; minute, glabrous. *Stamens* 3 rarely 2. *Stigmas* laterally exserted low down; styles terminal. *Caryopsis* narrowly linear in outline, or tapering upwards, subterete; embryo short. *Pedicelled spikelet* similar to the sessile, but usually relatively broader and flatter, or more or less reduced, and then sometimes quite small. *Glumes* more or less membranous, the lower aristulate or muticous.

Annual or perennial grasses, rarely suffrutescent, never very tall. *Culms* slender. *Leaf-blades* folded in the bud, usually narrow. *False panicles* varying from very loose and scanty to densely fascicled, with the spathes mostly very narrow, scariosus, membranous or lower down herbaceous.

Key to the species of *Schizachyrium*.

Annuals.

- Fastigiate branched; racemes silkily villous; joints appendaged. 1. *S. exile*.
- Divaricately branched; racemes sparsely hairy; joints 2-toothed. 2. *S. brevifolium*.

Perennials.

Joints of the racemes 5-7 mm. long, glabrous or ciliolate; upper lemma of sessile spikelet deeply bifid. 3. *S. semiberbe.*

Joints of the racemes half the length of the sessile spikelet, furnished with long white hairs. Upper lemma of sessile spikelet with two short teeth. 4. *S. delavayi.*

1. ***Schizachyrium exile* Stapf** in Flor. Trop. Afr. IX, 191. Syn. *Andropogon exilis* Hochst. in Flora XXVII (1844) 241.

Annual. *Culms* fascicled, from few to very many, erect, 15-60 cm. high, many noded, terete or slightly compressed below, branched, glabrous. *Leaf-blades* linear, tapering to an acute point, 2·5-15 cm. long, 2-3 mm. wide, glabrous, with a few long white hairs at the junction with the sheath, scabrid on the margins and towards the tip, green, turning red; sheaths somewhat loose, terete, lower ones compressed and keeled, glabrous and smooth, the upper spathaceous; ligules membranous, short, rounded. *Spathes* narrow acute, 2·5-3·5 cm. long, as long as, or slightly shorter than, the racemes, narrowly linear-lanceolate, acute, at length often turning a brilliant red.

Racemes sub-sessile in the spathe, or on distinct, but very short, peduncles with hollowed out, clavate tips, which on one side are produced into a short, obtuse appendage; racemes 1·8-3 cm. long, 8-12-jointed; joints 4-6 mm. long, gradually widening upwards, clavate, pinkish above, with an oblique, membranous, minutely denticulate or almost entire appendage, which is tubular at the base and from 1 to over 2 mm. long; pedicels slender, sub-linear, slightly shorter than the joint; hairs as on the joint. *Sessile spikelet* narrowly linear-lanceolate, slightly convex on the back, including the bearded callus up to 8 mm. long, greenish or turning red. *Glumes* equal; the lower sub-coriaceous, more or less convolute, lanceolate when flattened out, produced into a narrow more or less 2-dentate acumen, with long white hairs on the back to beyond the middle, scaberulous along the keels of the back; intracarinal nerves 2, very faint or

quite obscure; upper linear-subulate in profile, with a long fine point, membranous, 1-nerved, keeled above the middle. *Lower floret* reduced to a linear-lanceolate, acute, hyaline, ciliolate, nerveless lemma up to 4 mm. long. *Upper floret* hermaphrodite; lemma bifid to a quarter from the base, not quite 4 mm. long, segments acute, glabrous, awn 12-20 mm. long, kneeled at, or slightly below, the middle; column brown, bristle white. *Stamens* 2 (?); anthers narrowly linear, 1.25-2 mm. long, often much smaller. *Caryopsis* very slender, linear, almost 4 mm. long, embryo about half its length. *Pedicelled spikelet* reduced to a lanceolate-subulate glume, which is 2-keeled with 1 intracarinal nerve produced into a bristle-like awn, 6-8 mm. long, with or without a minute mucro at its base, very rarely a rudimentary 2nd glume.

This grass, when young, is eaten by cattle. Plains districts of the lower Assam Valley.

2. *Schizachyrium brevifolium* Nees, Agrost. Bras. (1829) 332. Syn. *Andropogon brevifolius* Sw., Prod. Veg. Ind. Occ. 26.

Annual. *Culms* weak, up to 60 cm. long, usually ascending from a decumbent base, rarely erect, branched from most of the nodes, slender, geniculate, glabrous, compressed below, *Leaf-blades* linear, constricted at the base, obtuse or sub-obtuse or suddenly narrowed to a sharp point, 2.5-3.5 cm. long, 2-6 mm. wide, upper narrower and more acute, glabrous, smooth, except along the margins and on the lower side of the midrib, nerves very fine; leaves like the spathes eventually turning red; leaf-sheaths compressed, the lower keeled, somewhat lax, glabrous, smooth, the uppermost spathe-like; ligules membranous, very short, ciliolate. *Spathes* on sub-capillary curved or flexuous branchlets, very narrow, acute, reaching to the base of the racemes or slightly exceeding them, 3-2 cm. long.

Racemes borne on filiform, upwards clavate, peduncles, slender, from less than 1.25 cm. to over 2.5 cm. long, 5-11-jointed; joints 2.2-5 mm. long, widening upwards from a slender base, tips 2-toothed, glabrous, smooth. *Sessile spikelet*

linear-lanceolate, acuminate, more or less convex on the back, pale green, including the minute callus, which is more or less shortly bearded, about 3 mm. long. *Glumes* equal; lower thinly chartaceous, 2-dentate, scaberulous along the keels, with very faint intracarinal nerves, smooth or very minutely scaberulous on the back; upper glume boat-shaped, acute, 1-nerved, ciliolate. *Lower floret* reduced to an elliptic-obtuse, hyaline, nerveless, ciliolate lemma, distinctly shorter than the glumes. *Upper floret* hermaphrodite; lemma 2-fid almost to the base, 1.5 mm. long, segments linear-oblong, sub-obtuse, sparingly ciliolate, awn 8-16 mm. long. *Anthers* .5 mm. long, deep red or purple. *Caryopsis* sub-linear, tapering upwards. *Pedicelled spikelet* reduced to a minute glume, often passing indistinctly into the pedicel and produced into a bristle like awn about 4 mm. long.

KHASI and JAINTIA HILLS, NAGA HILLS, DARRANG.

3. Schizachyrium semiberbe Nees, Agrost. Bras. (1829) 336. Syn. *Andropogon semiberbis* Kunth, Enum. Pl. I. 489.

Perennial. *Culms* 60 cm. to almost 2 m. high, erect or slightly geniculate from a short rhizome, rather stout, terete or compressed, branched (copiously or sparingly). *Leaf-blades* linear, shortly acute, gradually passing into the sheath or slightly contracted at the base, up to 50 cm. long, 2-5 mm. wide, flat or folded when young, firm, glabrous, rarely hairy, smooth below, scabrid above and along the margins; leaf-sheaths firm, striate, glabrous, or more or less hirsute, the lowest compressed and keeled, the upper terete, tight; ligules scabrid, truncate, ciliate. *Spathes* very narrow, 4-6 cm. long, the upper bladeless or with a minute blade.

Racemes on peduncles which are entirely, or almost entirely, enclosed in the spathe and thickened towards the urceolate, minutely denticulate tips, 4 to almost 5 cm. long, 8-14-jointed, slender; joints 5-7 mm. long, linear, cuneate, semi-terete, with an asymmetrical, urceolate, 2-dentate appendage, smooth on the back, glabrous or rarely obscurely ciliolate on the margins, straw coloured or reddish, pedicels similar, 3-5 mm. long, ciliate along the outer edge, (rarely

almost glabrous), hairs increasing upwards, the uppermost up to 2 mm. long. *Sessile spikelet* subulate-lanceolate to linear, 2-dentate, including the shortly bearded callus, 6-8 mm. long, glabrous. *Glumes* sub-equal; lower sub-coriaceous, reddish or dark-brown, rounded and smooth on the back beyond the middle, then thinner, pale, flat and distinctly 2-keeled, with the keels scaberulous, intracarinal nerves 2-4, very obscure; upper glume slightly shorter, firmly membranous, rather thin above the middle, subulate, acuminate, 1-nerved, keels scaberulous, margins ciliolate. *Lower floret* reduced to a linear-oblong, acute lemma up to 5 mm. long, sub-2-nerved, hyaline, ciliolate. *Upper floret* hermaphrodite; lemma 4 mm. long, divided to three quarters of its length, base obovate, segments lanceolate, acute, ciliolate; awn 14-16 mm. long, kneed in the middle, column dark, bristle white; palea absent or a microscopic scale. *Stamens* 3; anthers 1 mm. long. *Caryopsis* cylindric, over 2 mm. long; scutellum less than half the length. *Pedicelled spikelet* male, (or neuter and more or less reduced) narrowly lanceolate, acuminate, about 4 mm. long, glabrous; lower glume flat, 2-keeled, minutely 2-dentate, with a short bristle, minutely scaberulous upwards, intracarinal nerves 5-7; upper glume sub-hyaline, sub-3-nerved, eciliate. *Lemma* of lower florets as in the sessile spikelet. *Lemma* of upper floret entire, linear-oblong, sub-acute, over 2 mm. long, hyaline, 1-nerved, ciliolate, awnless.

A good fodder for stock at all times. Found near JOWAI, KHASI and JAINTIA HILLS, 3,000 ft.

4. *Sachizachyrium delavayi* (Hack.) Bor, Ind. For. Rec. (Bot.) I. 3 (1938) 95. Syn. *Andropogon delavayi* Hack., Mon. Androp. (1889) 404.

Culms 40-120 cm. tall, slender to stout, erect, terete many-noded, except for the nodes very glabrous, not striate, branching or not, flower bearing branches from the upper nodes. *Leaf-blades* linear, long tapering to a fine point, 8-25 cm. long, 3-4 mm. broad, flat, rigid, sub-erect, glaucous, glabrous or strigose-pubescent below, margins scabrid, many-nerved, median nerve very broad, white; sheaths rather loose,

striate, smooth and glabrous below, softly pubescent towards the top, lowest or the lower compressed and keeled, upper spathe-like; ligule a narrow membranous ring, convex upwards, ciliate. True spathes 2-3 cm. long, without blades, mucronate, reddish.

Racemes 2-3 cm. long, compressed, glabrescent, green or purplish; joints and pedicels about half the length of the sessile spikelet, furnished with white hairs which increase in length upwards, the upper hairs as long as the joint. *Sessile spikelets* including the callus about 5 mm. long; callus shortly bearded. *Lower glume* chartaceous-membranous, narrowed above, very obtuse, entire or emarginate, margins narrowly inflexed, keels sub-marginate, back flat, 3-5-nerved, very glabrous, nerves evanescent above the middle. *Upper glume* as long as the lower, membranous, broadly lanceolate, acute, keeled above, 3-nerved, very glabrous. *Lower floret* reduced to a hyaline, nerveless lemma as long as the lower glume, oblong-obtuse, ciliolate. *Upper floret* hermaphrodite; lemma scarcely broader than the base of the awn, with 2-minute lanceolate teeth, glabrous; awn 8-10 mm. long, column glabrous. *Lodicules* glabrous. *Anthers* 2.5 mm. long. *Pedicelled spikelets* male, lanceolate-oblong, equalling the sessile, resembling them in all respects except that the lemma of the upper floret with its awn is missing.

LARURI, NAGA HILLS, 2,500 ft.

27. HETEROPOGON Pers.

Spikelets 2-nate, those of the lower (1 to many) pairs alike in sex and shape, male or neuter, of the upper pairs differing in sex and strikingly so in shape, one of each pair sessile, the other pedicelled on the many-jointed rhachis of solitary racemes terminating the culms and their upper branches; rhachis tough, or upwards tardily disarticulating and glabrous between the homogamous pairs, readily disarticulating above them; homogamous pairs long persistent, the spikelets of the heterogamous pairs falling separately, the pedicelled with the pedicels, the sessile with the contiguous joint of the rhachis and the adjacent pedicel or its

base. *Florets* 2, lower reduced to an empty lemma, upper female or hermaphrodite in the sessile spikelets of the heterogamous pairs, male or neuter in all the other spikelets. *Fertile spikelet* terete or sub-terete, awned; callus long, pungent, densely bearded upwards. *Glumes* equal; the lower coriaceous, rarely chartaceous, more or less tightly involute, quite keelless, nerves obscure, often connected by a few transverse nerves in the upper part; the upper with a deep longitudinal groove on each side, coriaceous, rarely chartaceous between them, thinner towards the margins, membranous at the tip, 3-nerved. *Lemma* of the lower floret hyaline, nerveless, of the upper floret stipitiform from a hyaline very slender base, cartilaginous upwards and passing into a usually stout, geniculate awn. *Palea* small or absent. *Lodicules* more or less reduced, to very minute. *Stamens* 3, often rudimentary or absent. *Stigmas* exserted terminally or laterally. *Grain* more or less linear in outline, sub-terete, slightly dorsally compressed; embryo somewhat exceeding the middle of the grain. *Male* (or neuter) *spikelets* dorsally flattened, usually slightly asymmetric and often somewhat twisted, muticous, imbricate. *Lower glume* herbaceous, many nerved, winged upwards from one or both keels; *upper* membranous, lanceolate-oblong, acute, 3-nerved. *Lemmas* hyaline, 1-nerved, well developed or more or less reduced. *Stamens* 3 or absent.

Perennial or annual grasses with simple or more often, upwards branched culms; branches few to many, mostly flowering and gathered into a spathate panicle; racemes conspicuously dorsi-ventral, the bases of the male (or neuter) spikelets sub-imbricate on the back of the raceme, their upper parts bending forward round the sides, forming a hollow in which the fertile spikelets are enclosed, with their awns exserted antically and often inter-twisted.

Heteropogon contortus Beauv. ex Rœm. et Schult., Syst. Veg. II (1817) 836. Syn. *Andropogon contortus* Linn., Sp. Pl. (1753) 1045.

Perennial, cæpitive, up to over 1 m. high, innovations extra- and intra- vaginal. *Culms* erect or geniculate ascend-

ing, more or less compressed below, glabrous, smooth, quite simple or more often branched. *Leaves* glaucous-pruinose, linear from an equally wide base, acute, tapering to a fine point, 7·5-23 cm. long, 3-7 mm. wide, flat, glabrous or with a few tubercle-based hairs towards the base particularly on the margins; margins cartilaginous, slightly rough; midrib slender, prominent below; sheaths compressed, keeled, quite glabrous or with a few tubercle-based hairs towards the mouth; ligules short, truncate, ciliolate.

Inflorescence a single terminal raceme, or more often several flowering branches, simple or divided from the base, forming tiers and collected into a scanty, rarely copious, and more or less fastigiate, spatheate panicle. *Spathheoles* narrow, long-tapering to an acute point, 7·5-10 cm. long, herbaceous to sub-herbaceous, glabrous. *Peduncle* shortly filiform, strict or slightly arched, sub-terminally exserted during flowering, then lengthening out. *Racemes* somewhat stout, 2·5-7·5 cm. long, of 3-10 homogamous and, frequently up to 12, heterogamous pairs; joints 4-2 mm. long, rufous-ciliate on the sides, cilia increasing upwards and forming a dense beard, concealing the joint and the base of the pedicel; pedicels glabrous 1 mm. long, disarticulating at the base with a very oblique scar. *Glumes* equal, coriaceous; lower tightly involute, truncate, minutely pubescent or hirtellous, about 9-nerved, nerves slightly raised; upper glume narrowly linear-oblong, sub-obtuse, sides much thinner than the hispidulous, coriaceous, very obtuse, dorsal keel. *Lower floret* reduced to a linear-oblong, hyaline, ciliolate, nerveless lemma, 3 mm. long. *Upper floret* female; lemma stipitiform from a very slender hyaline base, cartilaginous above it and passing into a stout geniculate awn, 5-10 cm. long; column at length dark-brown, shortly greyish pubescent; palea absent. *Lodicules* microscopic. *Stamens* absent or reduced. *Stigmas* exserted terminally. *Caryopsis* linear 3·3-5 mm. long, semi-terete, grooved on the face, whitish. *Male spikelets* all alike, or the lowest somewhat reduced, dorsally flattened, oblong-lanceolate, sub-acute, 8-10 mm. long, green, the sessile almost symmetric, the pedicelled somewhat asymmetric and contorted; glumes sub-equal, the lower herbaceous, closely many nerved, glabrous or variously hairy, hairs

tubercl-based, few or many in a single row along the margins, or spread over a marginal zone, or all over and then sometimes long and rigid and spreading, keels more or less unequally winged upwards, inflexed flaps very narrow; upper glume membranous, acute, 3-nerved, ciliate upwards; lemmas linear-ob lanceolate, hyaline, 1-nerved, ciliolate; of the lower floret 6-7 mm. long and obtuse, of the upper slightly shorter, narrower, acute; lodicules small; anthers 3 mm. long.

A very variable grass, especially in so far as the pubescence on the inflorescence is concerned. A common grass in dry places in the hills and foothills. It can be made into a good hay provided the awns can be extracted. Common in dry places, plains and hills.

28. THEMEDA Forsk.

Spikelets 2-nate (the terminal 3-nate) those of the lower 2 pairs alike in shape and sex, male or neuter, sessile to sub-sessile and closely approximate so as to form an involucre, of the following pair or pairs differing in sex and conspicuously so, in shape, one of each pair sessile, the other pedicelled on the rhachis of solitary racemes terminating the culms and their upper branches; rhachis terete, tough, or tardily disarticulating and glabrous between the homogamous pairs, readily disarticulating below the fertile spikelets; homogamous pairs or at least their sessile members persistent, the spikelet of the heterogamous pairs falling separately, the pedicelled with the pedicel, the sessile with the adjacent joint (if more than one) and the base or bases of the adjoining pedicels. *Florets* 2, lower reduced to an empty lemma, upper male or neuter in the homogamous spikelets and the pedicelled members of the heterogamous pairs, hermaphrodite in the sessile members of the latter. *Fertile spikelets* terete, awned or awnless; callus usually acute to pungent, densely bearded, beard more or less concealing the adjacent joint or pedicel bases. *Glumes* equal, coriaceous except at the membranous tips; lower tightly involute, quite keelless, nerves very fine, obscure except in transmitted light, the upper with a deep longitudinal groove on each side, very firm between these, thin along the margins, 3-nerved. *Lemma* of lower floret hyaline, nerveless, of upper floret stipitiform from a 1-nerved, hyaline base, cartilaginous up-

wards and passing into a short geniculate awn, or hyaline and 1-nerved throughout, with the nerve becoming stouter upwards and passing into a narrow, more or less reduced awn or awnless. *Palea* hyaline, nerveless, small or 0. *Lodicules* 2, somewhat large, glabrous. *Stamens* 3. *Stigmas* exserted, sub-terminal or from near the middle of the floret. *Caryopsis*, linear-obovate, sub-terete, grooved on the face; embryo about half as long as the grain. *Involucral spikelets* dorsally much compressed, awnless. *Lower glume* more or less herbaceous 2-keeled; upper membranous, very rarely suppressed. Both florets present or one or both suppressed; their lemmas hyaline, the upper with or without a palea. *Pedicelled spikelets* of the heterogamous pairs similar to those of the homogamous pairs, but narrower.

Annual or perennial usually coarse grasses, with scanty to compressed or decompound, spathate panicles and scattered, or more or less crowded and often glomerate, short, 1-2- (very rarely 3-) nerved, awned or awnless racemes of spikelets.

Key to the species of *Themeda*.

Pairs of involucral spikelets inserted at the same level, 5-10 mm. long.

Sessile spikelets solitary in raceme.

Racemes in densely congested heads, awns 30-60 mm; involucral spikelets 6-10 mm. long.

1. *T. triandra*.

Racemes loosely scattered, awns 30-35 mm.; involucral spikelets 5-6 mm. long. . . .

2. *T. laxa*.

Sessile spikelets 2 in each raceme. . . .

3. *T. strigosa*.

Pairs of involucral spikelets inserted at different levels.

Involucral spikelets glabrous or nearly glabrous.

Fertile spikelets with an imperfect awn or awnless.

4. *T. villosa*.

Fertile spikelet with a well-developed geniculate awn.

5. *T. caudata*.

Involucral spikelets bearing fulvous, tubercled-based hairs.

Fertile spikelet with well-developed geniculate awns.

Stout grasses.

Column of awn 3·75-5 cm. long; involucral spikelets 12-20 mm. long.

6. *T. arundinacea*.

Column of awn 2·5 cm. long, in-			
volucral spikelets 11-12 mm. long. . .	7.	<i>T. subsericans</i> .	
Slender, wiry grass. ..	8.	<i>T. huttonensis</i> .	
Fertile spikelets awnless. ..	9.	<i>T. intermedia</i> .	

1. **Themeda triandra** *Forsk.*, Flor. Aegypt.-Arab. (1775) 178. Syn. *T. forskalii* *Hack.*, Mon. Androp. (1839) 659.

Perennial. *Culms* erect or geniculate ascending, rounded or moderately compressed, slightly striate, leafy and branchy to the base, very glabrous. *Leaf-blades* linear, rounded at the base, insensibly contracted to the tips, acuminate or rarely slightly obtuse, rigid, spreading, the adult leaves flat, the median nerve fine, acute below; sheaths more or less compressed, keeled, the upper spathe-like, dilated, with the limb exceeding the raceme, the lower exceeding the internodes; ligules 1·1·5 mm. long, rounded, truncate, membranous, reddish, ciliate.

Inflorescence a leafy panicle, narrow, often nodding at the top; lower branches solitary, rather long, the lower bare for some distance, the upper in twos or threes, all filiform, very glabrous, flower bearing branches crowded towards the summit, racemes in obconical or broadly ovate fascicles, rarely sub-globose, crowded; spiciform racemes 12-17 mm. long with a peduncle 1 mm. long in the spathe. *Spatheoles* lanceolate, long attenuate, boat-shaped, keeled, compressed, with scarious margins, many-nerved. *Involucral spikelets* all sessile, lanceolate or linear-lanceolate acute or acuminate, rarely cuspidate, 8-10 mm. long, persistent; callus very short, gibbous, glabrous; lower glume keeled, often more or less scarious-marginate on one side, 9-11-nerved, glabrous or with rigid, appressed hairs tubercled at the base; upper glume lanceolate, acute. *Lower floret*; lemma oblong, acute or obtuse. *Anthers* 4-6 mm. long, rarely absent. *Sessile spikelets* hermaphrodite, one in a raceme, enclosed in the involucre, linear-oblong, sub-cylindrical, 7-10 mm. long; callus acute, curved 2·5-3 mm. long, glabrous in front, with reddish hairs on the sides, finally purplish-black, the length of the spikelet; lower glume 7-10 mm. long, coriaceous, very obtuse, often emarginate, margins broadly involute, back smooth to the

hase, shining, tubercular-scabrid at the top or channelled, finally 7-nerved; upper glume 7-10 mm. long, linear-oblong, very obtuse, glabrous, scabrid above, 1-nerved. Lower floret; lemma 4.7-7.5 mm. long, lanceolate, acute, glabrous, nerveless; upper floret; lemma 1-nerved; awn 3-6 cm. long; column hispid, brownish. Anthers 2 mm. long. Styles at least shorter than the stigmas. Pedicelled spikelets similar to the involucral spikelets, subulate, lanceolate, very acute, glabrous, consisting of two glumes and one lemma.

A valuable fodder before flowering. Common in the KHASI and NAGA HILLS, 3-4,000 ft.

2. *Themeda laxa* A Camus in Bull. Mus. Hist. Nat. Paris, XXVI, 266, 423, 1920. Syn. *Anthistiria laxa* Anderss. in Nov. Act. Sc. Upsal. ser. III. 2 (1856) 243.

Perennial. Stems tufted, slender, much branched, 60-120 cm. high, very leafy, smooth and glabrous, much branched. Leaves linear, up to 15 cm. long by 5 mm. wide, smooth and glabrous on the upper surface, a few scattered hairs on the lower surface, margins scabrid, with a few very long cilia 4.5 mm. long, base slightly but abruptly contracted; sheaths rather loose and compressed and spathe-like, soon fading and turning reddish brown; ligule absent.

Panicle slender consisting of fan-shaped fascicles or clusters of racemes about 1.25 cm. in diameter. Spatheole long acuminate, very narrowly cymbiform, 2.5-3.5 cm. long, hispid-scabrid on the margins. Spikelets of the involucre homogamous, male or neuter, 5-6 mm. long, often reddish with a green, glabrous callus; lower glume narrowly oblong, tip almost spinously acute, nerves 9-11, distant, back with scattered tubercles, each with a long white hair, chiefly on the upper half and often few in number; upper glume 5 mm. long with a fine median nerve and two to three nerves in each margin, margins narrowly inflexed, ciliate; lemma as long, hyaline; lodicules cuneate, micro-ciliate on the truncate end. Palea sometimes present as a minute scale. Sessile spikelets one, 4.25 mm. long (including the bearded callus); pedicelled spikelets 2.5 mm. long, tapering at the base into short pedicels. Lower glume of the sessile spikelet truncate,

obscurely 9-nerved, upper fourth of the glume closely scabrid-hispid. *Upper glume* narrower, longer, with incurved margins and rounded keel in which lies the awn of the upper lemma. *Lower floret*; lemma hyaline, linear, about 3 mm. long. *Upper floret*; lemma reduced to the hyaline base of a rarely smooth awn, 3-3.5 cm. long; lodicules very large, oblong-obcuneate. *Ovary* linear-oblong. *Pedicelled spikelets* very narrow, very sharply acute; lower glume many-nerved; upper scaberulous on the keel, margins ciliate inflexed.

Will probably be found in the BALIPARA FRONTIER TRACT.

3. Themeda strigosa Haines, Bot. Bihar and Orissa, 1051. Syn. *Anthistiria strigosa* Ham. ex Hook. f. F.B.I. VII (1897) 214.

A stout perennial grass up to 1.5 m. tall, with terete, smooth and polished culms. *Leaf-blades* linear-lanceolate, up to 30 cm. long, ending in a filiform tip, 3-4 mm. wide, smooth and glabrous; sheaths smooth, polished, keeled, rather loose; ligule a narrow ciliate membrane.

Inflorescence a very compound panicle up to 60 cm. long, with long slender upright branches, 2-3 branches from a leaf axil, leaflets from 2.5-7.5 cm. then with a leaf-bract bearing 2-several spatheoles and often a further slender branchlet which may be again similarly branched; spatheoles and racemes not hidden among the bracts. *Spatheoles* strongly nerved or ribbed, 1.1-2.5 cm. long, ciliate or not on the keel, subaristate, geniculate and bearded on the peduncle. *Racemes* of 4 involucral spikelets and two or more sessile hermaphrodite spikelets. *Lower glume* of involucral spikelets 3.5 mm. long, oblong lanceolate, many nerved, covered with tubercle-based bristles; upper glume subaristate, 3-5 mm. long; lemma empty, narrow, hyaline. *Hermaphrodite spikelets* usually 2, pale, ciliate on the callus with light-coloured hairs; lower glume hispidulous; upper wrapped round the slender awn which is usually about 1 cm. long. *Pedicelled spikelets* usually one to the lower sessile and two to the upper sessile spikelet; pedicels 1.25 mm. long, glabrous; lower glume 3.5 mm. long, lanceolate, acuminate, bristly; stamens 3.

ASSAM, Hamilton.

4. *Themeda villosa* Dur. et Jack., Ind. Kew. Suppl. I.
424. Syn. *Anthistiria villosa* Poir., Encycl. Suppl. i. 396.

A perennial grass. *Stems* tufted, very stout, up to 20 cm. tall, smooth, glabrous, polished, often solid, leafy. *Leaf-blades* 30 cm. long or more, linear-lanceolate tapering to a narrow base, more often glabrous than not, scaberulous on both surfaces, midrib white, strongly marked, lateral nerves prominent; margins somewhat thickened and scabrid; sheaths auricled at the mouth, strongly keeled below, smooth and glabrous, rather loose, finally slipping from the culms; upper spathe-like; ligules membranous, short, 1-2 mm. long, erose, not or very shortly ciliate.

Inflorescence a very large, leafy, decompound panicle. *Spatheoles* boat-shaped, keeled, many-nerved, scabrid on the keel; tip often setaceous-scabrid, 2·5-3 cm. long. *Peduncles* terete, 1-1·5 cm. long, villous at the top. *Involucral spikelets* four, homogamous male, inserted in pairs at different levels; lower glume lanceolate, 10-14 mm. long, many-nerved, 2-keeled, one narrowly winged, margins inflexed, hispid-ciliate on the margins, keels scabrid, sparsely hairy with short, rufous hairs on the dorsal surface or almost glabrous; upper glumes somewhat shorter than the lower glume, hyaline, 3-nerved, ciliate on the margins, nerves and bark scaberulous or shortly hairy; lemma 9 mm. long, lanceolate, ciliate on the margins; palea narrow ciliate; stamens three, anthers 5 mm. long.

Central racemes of two sessile and three pedicelled spikelets. *Sessile spikelets* 7-8 mm. long; callus densely hispid with short brown hairs; lower glume 7-8 mm. long, lanceolate-oblong, tip broadly truncate, margins inflexed, keels rounded, densely covered on back and sides with appressed short brown hairs, 7-8-nerved; upper glume 7 mm. long, narrowly lanceolate, 3-nerved, curved to the awn, tip obtuse, densely hairy on the dorsal surface. *Lower floret* barren; lemma 5·5 mm. long, lanceolate, hyaline; palea minute. *Upper floret* hermaphrodite; lemma lanceolate-acute, 6 mm. long, hispid on the keel; awn stout, short, 7 mm. long or absent. *Pedicelled spikelets* male; pedicels 3 mm. long ciliate-hispid on angles and back with brown hairs. *Lower glume* narrowly lanceolate-acuminate, 10-15 mm. long, 13-nerved,

scabrid on the nerves, sparsely hairy on the dorsal surface; upper glume 5-nerved, translucent, ciliate on the margins in the upper half, 3 mm. long, almost aristate; lemma 7-8 mm. long, hyaline, ciliate on the margins; palea shorter, hyaline, obtuse. *Stamens* 3, anthers 4-5 mm. long.

Common all over the province up to 5,000 ft.

5. Themeda caudata Dur. et Jack., Ind. Kew. Suppl. I. 424. Syn. *T. gigantea* Hack. sub-sp. *caudata* Hack., Mon. Androp. (1889) 676.

A very large caespitose grass from a stout root-stock with flattened stems, 3-6 m. tall. *Culms* greenish-yellow or pinkish. *Leaf-blades* linear, tapering to a fine point, equitant below, up to 1.5 m. long by 8-16 mm. wide, midrib broad and flat on the upper surface, surfaces glabrous, somewhat rough, glaucous below; margins scabrid; sheaths very smooth, striate and glabrous, ligule a very narrow ciliate ring, convex upwards.

Spathes and their spatheoles forming a very large, leafy and pendulous, compound panicle. *Spatheoles* 3-25.5 cm. long, finely acuminate, many nerved, glabrous, on slender peduncles enclosed with others and a branch in a spathe, these with other peduncles and branches in spathes of a lower order and so on. *Involucral spikelets*, 6-4 mm. long, in somewhat unequal pairs, one pair with longer calli than the others, one of each pair apparently often empty, the other staminate. *Lower glume* long, subulate sub-aristate, one margin much inflexed and its keel scantily ciliate and scabrid; back flat, scaberulous, about 9-nerved. *Upper glume* three quarters the length of the lower, 3-nerved, with an additional nerve on the margin, scaberulous; the lemmas of the floret sub-similar, hyaline. *Anthers* nearly as long as the spikelet. General raceme of 2 sessile spikelets and 2-3 pedicelled. *Sessile spikelet* with an oblique, densely brown-bearded, ultimately pungent callus, falling with its joint and pedicelled spikelet; lower glume very coriaceous, nearly covering the upper, 11-nerved; upper with hirsute keel and involute coriaceous margins; *lemmas* of the lower floret three quarters the length of the glume, empty; upper floret hermaphrodite; lemma

similar to the lower lemma, hyaline. *Lodicules* very large, oblong-lanceolate. *Caryopsis* firm, oblong, brown, 3·5 mm. long.

Plains of ASSAM.

6. Themeda arundinacea Ridley, Flor. Malay Penin. V. (1925) 212. Syn. *T. gigantea* Hack. sub-sp. *arundinacea* Hack., Mon. Androp. (1889) 672.

A tall tufted perennial grass. *Culms* up to 6 m. tall, smooth and polished, solid, 1·5 cm. in diameter, compressed. *Leaves* linear, gradually attenuate towards the base, tapering to a subulate tip, rough on both surfaces, very scabrid on the margins up to 1 m. or more long, 1·1-1·5 cm. wide; sheaths strongly keeled, smooth and glabrous, auricled, striate, often loose; ligule a membranous ring.

Inflorescence erect with nodding tip, very large, consisting of numerous compound racemes issuing from lanceolate-acuminate spatheoles 3-8 cm. long; peduncle in the spatheole short, hairy, 10 mm. long, swollen at the apex. *Involucral spikelets* inserted at different levels; 16 mm. long; lower glume 16 mm. long, lanceolate, covered all over the back with golden hairs from tubercle bases, 2-keeled, one margin more inturned than the other, many- and closely-nerved; upper glume a little shorter, 3-nerved, chartaceous, acuminate; lemmas 2, male or not. *Sessile spikelets* 3 mm. long, dark brown; callus sharp, bearded with brown hairs, 4 mm. long; lower glume oblong acute, 2-toothed, rich brown in colour, smooth and glabrous or sparsely hairy on the back, hairy on the sides at the top; upper glume as long as the lower and of the same texture. *Lower floret* empty; lemma hyaline. *Upper floret* hermaphrodite; lemma the hyaline base of a very stout awn which is up to 5 cm. long. *Pedicelled spikelets* seated on pedicels 3 mm. long; similar to the involucral but much more slender and delicate, covered on the back with numerous tubercle-based hairs.

A very common grass in savannah in the plains.

7. Themeda subsericans Ridley, Flor. Malay Penin. V. (1925) 212. Syn. *T. gigantea* sub-sp. *arundinacea* var. *sub-*

sericans Hack., Mon. Androp. (1889) 674; *Anthistiria subsericans* Nees apud Steud., Syn. Pl. Glum. (1854) 401.

A perennial grass up to 1 m. tall with leafy culms more or less hairy below the upper nodes. *Leaf-blades* linear-acuminate, tapering from the base to a fine point, rough on both sides, scabrid on the margins, hairy on the lower surface towards the base; sheaths scabrid and hairy; ligule a short membrane.

Inflorescence a panicle of compound racemes seated on peduncles concealed in spatheoles. *Involucral spikelets* male or neuter, 11-12 mm. long, covered on the back with numerous long, golden or rufous hairs; lower glume narrowly elliptic-acuminate, margins incurved, 2-keeled; upper glume rather more delicate, 3-nerved; lemmas 2, male or neuter, paleate or not. *Sessile spikelet* 10 mm. long, densely brown hairy; awn 2·5 cm. long, hispid on the column. *Pedicelled spikelets* similar to the involucral but rather narrower and more delicate.

DUMPEP, KHASI HILLS, 4,000 ft. and doubtless elsewhere.

8. Themeda huttonensis Bor, Ind. For. Rec. (Bot.) I. 3 (1938) 95.

Perennial, 60-100 cm. tall; culms slender, sub-terete or compressed, so much so as to be 2-keeled, smooth and glabrous, often markedly zigzag, much branched, in the upper part branched from each node. *Leaf-blades* linear, setaceous-acuminate, rounded at the base, up to 20 cm. long by 8 mm. broad, glabrous on the lower surface, scabrid on the margins and on the lower surface, with tubercle-based, long white hairs on the upper surface and margins near the base (4 mm. long); sheaths loose, strongly compressed and keeled, contracted towards the top; ligule membranous, convex upwards, very narrow to 1·5 mm. long, erose.

Inflorescence a very leafy panicle; flower bearing branches arising at a node within a leaf sheath bearing a reduced limb; dividing at each successive node upwards into 1-2 or 3 branches, limb of the sheath or spatheole gradually

getting smaller upwards; internodes long and therefore the panicle very lax and loose; ultimate spatheoles 2·5-3 cm. long, often with a minute limb, scabrid on the margins. *Spatheoles* compressed or cymbiform, lanceolate, acuminate, glabrous. *Racemes* solitary on a peduncle 1 cm. long, glabrous, usually with 2-fertile florets, seated in an involucre of 4 homogamous spikelets and with 2-pedicelled spikelets to each sessile (rarely only one). *Fertile spikelet*, including the callus, 5·5 mm. long; callus acute, densely bearded; pedicel bases inserted on the callus, 2 mm. long or shorter, glabrous, articulation oblique. *Lower glume* chartaceous, oblong-truncate, 11-nerved, smooth and shining in the lower three quarters, scabrid at the top, margins strongly involute. *Upper glume* chartaceous, margins involute, linear, oblong, contracted towards the truncate tip, 1 central nerve and 3 marginal, strongly depressed and clasped by the lower glume on each side of the central nerve, glabrous; lower floret empty; lemma linear-lanceolate, 4·5 mm. long, margins slightly involute, ciliate on the margins, hyaline, nerveless; upper floret hermaphrodite; lemma 1-nerved, hyaline, forming the base of a stout, scabrid awn up to 2·5 cm. long; palea absent or a minute, hyaline scale; lodicules 2, large, oblong scales; ovary glabrous; styles connate into a column; stigmas exserted laterally (?). *Involucral spikelets* 11-12 mm. long, inserted at different levels, oblong-lanceolate to linear-lanceolate, persistent; glumes sub-equal in length; lower herbaceous, convex on the back, with a few tubercle-based long hairs (4 mm.), 2-keeled near the margin, narrowly winged on the keel, margins narrowly involute, many nerved; upper glume membranous, narrowly ovate-lanceolate, acuminate, 3-nerved, margins involute and ciliate in the upper half. *Pedicelled spikelets* falling from the pedicels with a shortly bearded pungent callus, similar to the involucral spikelets except that they are glabrous and narrower; lower floret; lemma 6·5 mm. long, hyaline, 1-nerved, margins involute, ciliate on the upper half; upper floret; lemma linear-ob lanceolate, abruptly contracted into a very short bristle.

Common near LARURI, NAGA HILLS, 2,000 ft.

9. *Themeda intermedia* Dur. et Jack., Ind. Kew. Suppl. I. 424. Syn. *T. gigantea* Hack. sub-sp. *intermedia* Hack., Mon. Androp. (1889) 675.

A very tall grass up to 5 m. *Culms* smooth and polished, glabrous, solid, up to 1.5 cm. thick. *Leaf-blades* almost petioled, with the midrib very broad and grooved on the upper surface at the base, up to 1 m. long by 1.5 cm. wide, very scabrid on the margins and on both surfaces, glabrous; sheaths strongly keeled in the upper half, much shorter than the internodes above, rather loose, striate, smooth and glabrous; nodes bare; ligule a membranous ring.

Inflorescence a large nodding panicle of peduncled racemes of spikelets issuing from spatheoles. *Involucral spikelets* inserted at different levels, oblong-lanceolate, acuminate, tip often oblique; lower glume 13 mm. long, shape of the spikelet, with slightly inturned margins, many-nerved, covered on the back with numerous tubercle-based hairs; upper glume 10-12 mm. long, 3-nerved, membranous, minutely scabrid on the dorsal surface in the upper half; lower lemma hyaline, 1-nerved, 10 mm. long, epaleate, upper lemma hyaline, 1-nerved, 10 mm. long, epaleate or not, containing 3 stamens with linear anthers 3 mm. long. *Sessile spikelets* 10 mm. long, including the callus which itself is 2 mm. long, blunt and bearded with brown hairs; lower glume coriaceous, flat on the back, covered with brown hairs, oblong acute; upper glume of the same texture but glabrous on the inturned margins, lemma hyaline, the upper carrying a short bristle or awnless. *Pedicelled spikelets* like the involucral seated on pedicels 2-2.5 mm. long.

Fairly common in the KHASI and JAINTIA HILLS, 2,500-4,000 ft.

29. GERMAINIA Balansa et Poitrasson.

Racemes contracted into a terminal capitulum which is solitary, narrowly oblong, often long exserted from the uppermost sheath, not articulated with the peduncle, consisting of from 9-14 spikelets composed of two pairs of homogamous spikelets at the base, forming a false involucre, which are erect, crowded, sessile, muticous, each containing

2-diandrous male flowers; spikelets 2-3-nate, of which one is pedicellate, female and one-flowered and awned, and 1 or 2 sessile spikelets, 2-flowered and male, muticous, and at the top 1 terminal pedicelled, awned, female spikelet with or without 2 lateral spikelets. *Male spikelets* muticous; lower glume coriaceous, truncate, many nerved, convex on the dorsal surface; upper glume hyaline, membranous, rather longer, terete, narrower, narrowly lanceolate, 3-nerved. *Lower floret*; lemma hyaline, narrowly lanceolate, 1-nerved; palea present or absent. *Stamens* 2. *Upper floret*; lemma hyaline, lanceolate often mucronate; the palea as long, stamens 2, anthers long. *Female spikelets* awned, much smaller than the male, cylindrical, obliquely inserted on a pedicel with a bearded callus; lower glume papyraceous, linear, truncate, enclosing the obtuse upper glume which is similar but shorter. *Lower floret*; lemma hyaline, with a long awn scarcely dilated at the base; palea short, very broad, erose; lodicules 0. *Stamens* 0; styles short, slender; stigmas linear, long, narrow, exserted from the summit of the spikelets.

Perennial grasses with rigid stems and narrow leaves.

Germainia khasyana Hack. in Oestr. Bot. Zeitschr. XLI (1891) 50.

Perennial. *Culms* erect and ascending, 20-30 cm. tall, densely tufted and leafy, pruinose below the nodes, slender. *Leaf-blades* linear-acute, 3-4 cm. long, 2-3 mm. broad, rather rigid, flat, with scattered long white cilia on the margins and a few on the lower surface, all from tubercle-bases, otherwise glabrous, tapering gradually to a point, hardly or only slightly narrowed at the base; sheaths longer than the internodes, lax, hairy, hairs caducous, sparsely hairy on the nodes, old sheaths not collected at the base of the plant; ligules broadly ovate, 1·5-2 mm. long, glabrous, decurrent into the margins of the sheaths.

Inflorescence 1·2-1·4 cm. long, not including awns, linear-oblong made up of four male, 2-flowered spikelets forming an involucre, then with spikelets in groups of 2, each group with one pedicelled female and 1 or 2 sessile male, the male similar to the involucral spikelets but 1-flowered or

neuter, and with a narrower lower glume. *Involucral* spikelets inserted in twos, separated by a node about 1 mm. long: of the four, two are sessile and one pair on pedicels 6-8 mm. long, erect, appressed; lower glume 12-14 mm. long, coriaceous, broadly linear-oblong, tip broadly truncate, ciliolate, margins not implicate, polished and shining; upper glume nearly as long, narrowly lanceolate, obtuse, 3-nerved; margins involute, glabrous; lower floret male; lemma like the upper glume, obscurely 3-nerved; palea oblong, broad, 2-nerved, broadly involute; upper floret male; lemma 11-13 mm. long, narrowly linear, very acute, mucronate, hyaline, membranous, glabrous, nerveless; palea equal in size, narrower and sharper. *Stamens* 2. *Female spikelet*, 8 mm. long, (accompanied by one or two male lateral spikelets) linear, sub-cylindrical, brownish, with a callus 2 mm. long, very acute, curved, enveloped in yellow brown hairs; lower glume very obtuse, 3-lobed, 3-nerved, the lateral uniting with the median under the summit at right angles, hairy, reddish on the back; upper glume similar to the lower. *Lower floret*; lemma 6.5-7 mm. long, hyaline, truncate, denticulate, ciliolate at the top, nerveless. *Upper floret*; lemma membranous, linear, 1-nerved, terminating in a thick awn up to 6.5 cm. long, robust, with a brownish column covered with grey hairs. *Stigmas* about 6 mm. long, densely, though shortly, plumose.

KHASI and JAINTIA HILLS—Nartiung, 4,000 ft., Puriung, 4,500 ft.

Very common in marshes near Myntliah, 16 miles beyond Nartiung on the Nowgong road.

30. ISEILEMA Anderss.

Panicle large about half the length of the stem; branches usually fascicled and interspersed with scarious spathe-like bracts; proper spathes boat-shaped, acute, compressed, more or less herbaceous on the back, many-nerved with scarious margins; racemes fasciculiform, solitary at the apex of the stem and branches, articulate with the peduncle below the lowest spikelets, at length all falling away from it. *Spikelets* dimorphous, the lower whorled, male or neuter, forming an involucre round the inarticulate rhachis. *Involucral spikelets*

pedicellate; pedicels short flattened; lower glume oblong-lanceolate, 3-5-nerved; upper glume similar, 3-nerved; lemma hyaline, 1-nerved. *Lodicules* cuneate, retuse. *Anthers* violet. *Pedicellate spikelets* on long slender pedicels, similar to the involucral. *Fertile spikelets* lanceolate to linear-lanceolate; lower glume truncate, or shortly 2-fid at the tip; upper glume as long, muticous, hyaline, glabrous. *Lower floret*; lemma small, hyaline, sometimes absent. *Upper floret*; lemma reduced to the stipitate base of an awn longer than the spikelet.

Small annual or perennial grasses; stems slender, compressed, many noded. *Leaves* linear from a usually rounded, equilateral base; sheaths compressed, keeled, shorter than the internodes.

Iseilema prostratum Anderss., Nov. Act. Soc. Sc. Upsal. Ser. 3. ii (1858) 251. *Syn. I. wightii* Anderss., loc. cit.

Culms often prostrate and rooting at the base, finally ascending, 20-80 cm. long, leafy, branched below. *Leaf-blades* acute, 6-12 cm. long, 2-3 mm. broad, glaucescent or sometimes they and the whole plant reddish, glabrous, rather smooth below, above scabrid or very scabrid; sheaths loose, more or less bearded at the nodes, for the rest very glabrous or scaberulous or occasionally, the sheath subtending flowering branches with sparse spreading tubercle-based hairs; spathes always scabrous, with the keel more obviously tubercled; ligule short, truncate, membranous, ciliate.

Panicle occupying half the culm or more, linear oblong, rather dense, sub-interrupted, erect spreading, decompound in typical specimens; rhachis with bearded nodes; proper spathes 8-13 mm. long, linear-lanceolate, with scarious margins. *Involucrat spikelets* male or neuter, 3-3.5 mm. long, shortly pedicellate (pedicels bearded at the base) strongly compressed, lanceolate oblong, green or tinged with violet; lower glume sub-acute with five strong ribs on the back sulcate between the ribs; often verrucose beside the keels; upper glume glabrous with broadly inflexed margins, 1-nerved, long ciliate on the margins, nerve sometimes verrucose, lower floret absent; upper floret male; lemma about as long as the

glume or shorter, 2-3-toothed, nerveless, glabrous. *Anthers* 1·5-2 mm. long. *Pedicelled spikelets* on very slender pedicels half as long as the sessile, male or neuter resembling the involucral but more delicate. *Sessile spikelets* hermaphrodite, 1·5-3 mm. long, lanceolate; lower glume acute, obscurely 4-nerved; margins broadly inflexed, keels scaberulous, glabrous; upper glume equalling the lower in length, elliptic-lanceolate, acute or obtuse and mucronate, dorsum obliquely carinate; keels scabrid; lower floret neuter, lemma a narrowly linear hyaline scale; upper floret hermaphrodite; lemma reduced to the base of a stout awn; palea absent.

So far not collected in Assam but is likely to occur.

31. DIMERIA R. Br.

False spikes solitary, geminate or fascicled, often slender, unilateral, simple; rhachis inarticulate, tough, trigonous or flattened, pedicels very short, erect or appressed, sub-claviform; articulation straight. *Spikelets* numerous, solitary, homogamous with one hermaphrodite floret, often aristate, sometimes accompanied by the rudiments of a lower floret, laterally and strongly compressed, appressed laterally to the rhachis, articulate on short pedicels, linear or linear-oblong, callus often short, shortly or very shortly bearded, whitish. *Glumes* rather rigid; lower papyraceous or coriaceous, often narrowly linear, rounded on the back, keeled, muticous, spreading at anthesis, 1-nerved; upper glume similar, often longer and broader. *Lower floret* neuter; lemma empty, hyaline, often rolled lengthways, small, linear or oblanceolate, often nerveless and ciliate, without a palea. *Upper floret* hermaphrodite; lemma hyaline or rather rigid towards the insertion of the awn, rolled, carinate, 2-toothed or 2-lobed, rarely entire, 1-nerved, with a twisted awn inserted in the sinus; palea small or absent; lodicules absent or very small. *Stamens* often 2, one anterior, the other posterior, rarely 3; filaments short. *Styles* short, distinct; stigmas shortly exserted laterally towards the base of the spikelets. *Caryopsis* linear, laterally compressed, included in the lemma but free; embryo about $\frac{1}{3}$ the length of the grain.

Usually slender herbs, with narrow leaves.

Key to the species of *Dimeria*.

Perennial	..	..	..	1. <i>D. fuscescens</i> .
Annual.				
Rhachis hairy	..	..	..	2. <i>D. kurzii</i> .
Rhachis glabrous :—				
Rhachis .5 mm. wide; upper glume				
2.5 mm. or more long	..	..	..	3. <i>D. ornithopoda</i> .
Rhachis .3 mm. wide; upper glume				
2 mm. long	..	..	..	4. <i>D. tenera</i> .

1. *Dimeria fuscescens* Trin., Mem. Acad. Petersb.
ser. 6. 2 (1833) 335.

Culms 30-50 cm. tall, slender, narrowly fistular. *Leaf-blades* linear-acuminate, 5-9 cm. long, 3-4 mm. broad, rigid, insensibly tapering to join the sheath, setaceous-acuminate or not, glabrous or densely hairy in both surfaces; margins scabrid, often conspicuously ciliate near the base from tubercle bases; sheaths tight or lax, lower often scarious, glabrous or very densely hairy, smooth, hardly striate.

False spikes or racemes geminate or 3-nate, 4-10 cm. long, more or less robust, pedicelled, fuscous, sparsely hairy, dense-flowered; rhachis .6 mm. broad, depressed trigonous, more convex on the ventral surface than above, wing represented by a narrow ridge, glabrous but scabrid along the ridge, internodes 2-3 mm. long, equal. *Pedicels* small, stout, scabrid. *Spikelets* violet-fuscous, 4-5 mm. long, the lower 1-8 reduced to two empty glumes, solitary, secund, bifarious, laterally strongly compressed; lower glume 4-5 mm. long, subcoriaceous, glabrous or the keel spinulose-scabrid, scabrid on the back; upper glume linear-lanceolate, apex shortly acuminate, margins hyaline-membranous, 4 mm. long. *Lower floret* neuter; lemma obovate, 2.5-3 mm. long, obtuse, ciliate. *Upper floret* hermaphrodite; lemma 2.5-3.4 mm. long, 2-toothed, hyaline; awn inserted in the sinus, 4-8 mm. long; anthers 2.25 mm. long. *Caryopsis* 3.5 mm. long.

Common, 4-5,500 ft. in marshy places, KHASI and JAINTIA HILLS and NAGA HILLS.

2. *Dimeria kurzii* Hook. f. F.B.I. VII. (1897) 103.

Annual. *Culms* ascending, branched, very slender, long exserted at the summit, 30 cm. tall. *Leaves* linear-acute,

5-7 cm. long, 2-2·5 mm. broad, hairy above, hairs spiny and stiff below, margins scabrid; median nerve rather marked, two lateral nerves on each side; sheaths narrow, tubercle-based hairs numerous towards the top, glabrescent at the base; ligules very short, membranous.

Inflorescence a raceme, 3-5 cm. long, sometimes more or less curved, of 50-70 spikelets; rhachis .75-.9 mm. broad, back glabrous; margins densely and rigidly ciliate; internodes equal, less than half the length of the spikelet; pedicels almost absent, reduced to a strongly bearded callus. *Spikelets* 2·5 mm. long; glumes sub-erect, lower papyraceous, membranous, oblong, mucronulate, with sparse hairs on the back, margins longly and densely ciliate; upper oblong-acute, more or less ciliate, papyraceous with membranous margins. *Lower floret*; lemma oblong-lanceolate. *Upper floret* hermaphrodite; lemma hyaline, ovate, two-lobed from the upper third, glabrous, awned; lobes acute; awn 15-18 mm. long, twisted, kneeled, glabrous, rather scabrid, column shorter than the bristle. *Caryopsis* cylindrical.

NAGA HILLS, LARURI, 3,000 ft.

3. Dimeria ornithopoda Trin., Fund. Agrost. (1820) 167. t. 14.

An annual. *Culms* very slender, branched, sub-compressed, bearded at the nodes. *Leaves* rather soft, narrow, linear, setaceous-acuminate, glabrous or with tubercle-based soft hairs on both faces, 2·7 cm. long, 1·2 mm. broad; principal lateral nerves 1·2 on each side, the secondary few; sheaths keeled, shorter than the internodes, glabrous or hairy at the summit.

Spikes 2-3-nate, sessile, spreading or erect, reddish or brownish, 2-4 cm. long, glabrous or nearly so; rhachis sub-undulate, almost .5 mm. wide, glabrous; back smooth, flat, with a strong nerve, scabrid on the margins, keel very smooth; internodes sub-equal, 1·2-1·5 mm. long, shorter than the spikelets; pedicels small, very glabrous, .3 mm. long. *Spikelets* linear, 1·5-2 mm. long; callus bearded, reddish, .4-.5 mm. long; lower glume shorter than the spikelet, coriaceous, chartaceous towards the keel, often

membranous towards the margins, much spreading at anthesis, narrowly linear, obtuse or acute, keel scabrid, margins often ciliate; upper glume as long as the spikelet, papyraceous, acute or abruptly acuminate, twice as broad as the lower, keel puberulous, sometimes with stiff hairs, margins ciliate. *Lower floret*; lemma short, sometimes very much reduced, narrowly linear-acute, nerveless, glabrous. *Upper floret* hermaphrodite; lemma 1.5 mm. long or shorter, oblong-acute, shortly 2-toothed, glabrous; awn slender 9-10 mm. *Stamens* .6 mm. long. *Style* twice as long as the stigmas. *Caryopsis* 2 mm. long.

A very common grass in the hills, 3-5,000 ft.

4. Dimeria tenera Trin., Mem. Acad. Petersb. ser. 6. ii. (1833) 335.

This is a very slender species very similar to *D. ornithopoda* Trin. but smaller in all its parts. Common in the hills and foothills.

32. ISCHÆMUM Linn.

Racemes spiciform, solitary or geminate, often digitate, rarely fascicled or sub-paniculate, compressed; rhachis fragile, compressed, many-jointed, often somewhat thick. *Spikelets* 2-nate, similar or diffrent in form or sex, the one pedicelled, falling at last from the pedicels; the other sessile, finally falling together with the contiguous joint of the rhachis, all 2-flowered, the lower floret often male, rarely hermaphrodite, the upper hermaphrodite, often male in the pedicelled spikelet, both spikelets awned or muticous, slightly dorsally compressed or the pedicelled appearing to be laterally compressed, one of the sides being more or less suppressed. *Sessile spikelets*; callus obtuse, often broad; glumes equal or almost so; lower glume papyraceous or coriaceous, muticous, margins infolded, more or less keeled, with back almost flat; upper glume of the same consistence, concave, keeled at least at the top, sometimes awned. *Lower floret* often male; lemma membranous, papyraceous or hyaline, muticous; palea narrow, often ciliate. *Upper floret* hermaphrodite; lemma hyaline or membranous, often bifid, awned or mucronate, very rarely muticous, often 3-nerved, nerves confluent towards the origin of the awn; paleas hyaline, nerveless

or rarely 2-nerved. *Lodicules* quadrangular, cuneiform. *Stamens* 3, those in the hermaphrodite flower sometimes reduced. *Stigmas* oblong or linear. *Pedicelled spikelets* often broader and rudimentary; upper glume with a keel which looks median but is actually lateral. *Upper floret*; lemma often muticous, rarely as in the sessile spikelet.

Often perennial plants of wet places. *Culms* usually decumbent at the base. *Leaves* often rolled in youth, then flat.

Key to the species of *Ischænum*.

Lower glume of sessile spikelets with nodules and rugosities :—

- Perennial; nodules marginal. 1. *I. imbricatum*.
- Annual; rugosities transverse. 2. *I. rugosum*.

Lower glume of sessile spikelet without nodules or rugosities :—

Lower glume of sessile spikelet winged above the middle; upper glume keeled and winged :—

- Wings broad; margins of lower glume expanded in the lower half and incurved; spikelets 4·5-5 mm. long. 3. *I. aristatum*.

Wings narrow; margins of lower glume not expanded; spikelets 6-7 mm. long. 4. *I. hubbardii*.

Lower glume of sessile spikelet wingless; upper glume keeled but not winged :—

- Spikelets 6-7 mm. long; callus 1·5 mm. long; stout grass. 5. *I. hirtum*.

Spikelets 2·5-4 mm. long; callus 5 mm. long; slender grass. 6. *I. timorense*.

1. *Ischænum imbricatum* Stapf ex Ridley, Flor.

Mal. Pen. V. (1925) 200. Syn. *I. aristatum* var. *imbricatum* Hack., Mon. Androp. 203; Hook. f., F.B.I. VII (1897) 127. (not of Linn.).

Perennial. *Culms* 3-1·2 m. tall, robust or slender, erect or decumbent, then ascending, almost compressed, often branchy at the base, thickened under the inflorescence. *Leaf-blades* linear-lanceolate or lanceolate, acuminate, the upper rarely somewhat cordate, the others narrow at the base, flat, rigid, 10-25 cm. long, 6-25 mm. wide, glabrous or with silky hairs, margins very scabrid; sheaths somewhat lax, keeled at

the top, rounded at the base, glabrous or hirsute; ligules 4-8 mm. long or almost absent, finally lacerate.

Spiciform racemes 2-3, rarely erect, stout or slender, 5-12 cm. long; rhachis very fragile, with thick joints, swollen or clavate, shorter than the spikelets, densely pubescent; callus very depressed, pubescent, .8-1 mm. long. *Sessile spikelets* oblong, 6-7 mm. long; lower glume 6-7 mm. long, oblique or lanceolate, summit obliquely obtuse, often 2-toothed, coriaceous towards the base, without striæ, upper part papyraceous, 5-7-nerved, nerves anastomosing, margins narrowly inflexed, narrowly winged on the margins; wings papery and ciliate; back flat; at the base 2-4 nodular swellings often joined by transverse depressions; upper glume 6-7 mm. long, papery, ovate-lanceolate, acute or mucronate, keel scaberulous, 1-nerved. *Lower floret* male or female; lemma 5.5-6.5 mm. long, hyaline or almost so, lanceolate acute, margins inflexed, 1-3-nerved, enclosing the palea which is oblong-lanceolate, rather thick, glabrous, 2-nerved; anthers 3 mm. long. *Upper floret* hermaphrodite; lemma 4.4-5 mm. long, ovate-oblong, 1-3-nerved, bifid for one quarter or more, lobes lanceolate, acute or obtuse, with an awn 10-14 mm. long in the sinus; column brownish, glabrous, straight; palea rather shorter, oblong, glabrous, nerveless. *Caryopsis* 3.5-5 mm. long, oblong-ellipsoid, compressed. *Pedicelled spikelets* not articulate on the pedicel, dimidiate-ovate, rather smaller than the sessile, pedicel 1.2-2.5 mm. long, amorphous, thick, angular, pubescent; lower glume ovate or very narrow, acute, one margin straight, the other very broadly winged, the wing almost as big as the remainder of the glume, coriaceous, flattened, shortly pubescent, white or reddish, 7-nerved; upper glume and lower floret as in the sessile spikelets; the upper floret often male, lemma ovate, entire or 2-toothed, muticous or mucronulate, very rarely with an imperfect awn.

Very common. KHASI and JAINTIA HILLS, 4000 ft.; also in the plains.

2. *Ischænum rugosum* Salisb., Ic. Stirp. Rar. (1791)
l. t. 1.

An annual. *Culms* 15 cm.-1 m. tall, erect or ascending

in robust tufts, branching at the base, branches often 2-nate, compressed, very glabrous, swollen at the top. *Leaf-blades* soft, flat, linear or almost lanceolate, base narrow and rounded, setaceous-acuminate, 5-25 cm. long, glabrous or with scattered hairs, margins very scabrid, nerves slender; sheaths lax, auricles at the throat passing into the ligule, compressed, keeled at the top, very glabrous or somewhat scaberulous, margins ciliolate, upper sheaths often aphyllous; ligules often oblong, obtuse, glabrous or ciliolate.

Inflorescence of 2 spiciform racemes, rarely one, rather large, 3-8 cm. long, erect; rhachis very fragile, joints 2·5-4 mm. thick, sub-claviform, trigonous, margins glabrous or the outer shortly and softly ciliate, not excavated at the base. *Sessile spikelet* greenish, ovate-oblong, obliquely obtuse at the summit, 3·5-6 mm. long, callus thick, silky; glumes glabrous; lower glume membranous, herbaceous, flattened, thin at the top, cartilaginous and shining at the base, rolled, back convex, rugose, with 5-6 transverse folds, margins inflexed, scabrid-ciliate, winged in the membranous part, 5-7 green nerves visible from outside, prominent and anastomosing, many-nerved inside; upper glume 3·5-6 mm. long, ovate, acute or obtuse, compressed laterally, back coriaceous, keel acute, glabrous in the centre, sinuous, slightly winged and ciliate at the top, 3-nerved, scabrid. *Lower floret* neuter; lemma 2·5-5·5 mm. long, hyaline, lanceolate, acute, margins inflexed, sub-nerved, glabrous; palea a little shorter, rather like the lemma, 2-nerved. *Upper floret* hermaphrodite; lemma 2·2-3 mm. long, hyaline, ovate-oblong, bifid for one-third or one-half the lemma, 3-nerved, lobes lanceolate; awn variable, short or long, brownish at the base; palea hyaline, ovate-lanceolate, glabrous, nerveless. *Lodicules* small, cuneiform. *Anthers* 1·5 mm. long. *Pedicelled spikelets* 2·5-4·5 mm. long, not articulate on the pedicel, half ovate (dimidiate-ovate); pedicel thick, confluent with the callus of the sessile spikelet, shorter than the spikelet, more slender than the joints of the rhachis; lower glume with a broad wing down to the lower third of the glume, whitish, scabrid, ciliolate, with 2-4 rugosities, often rather indistinct; upper glume not keeled, nor ciliate; upper floret; lemma entire, oblong, obtuse, muticous or shortly 2-toothed, awned with a perfect or imperfect awn 5 mm. long;

the remainder as in the sessile spikelet; very rarely with a more or less rudimentary floret.

Throughout the province up to 2,000 ft.

3. **Ischænum aristatum** Linn., Sp. Pl. (1753) 1049.
Syn. *I. ciliare* Retz., Obs. VI (1791) 36.

Perennial. *Culms* 50-60 cm. tall, slender, erect or decumbent and rooting at the base, tufted, a little compressed, bare at the top. *Leaf-blades* rather rigid, linear or linear-lanceolate, acute, flat, base narrow, or in the upper leaves almost rounded, 5-15 cm. long, 4·5-12 mm. broad, pubescence appressed, rarely glabrescent, margins very scabrid, nerves slender; sheaths compressed, more or less keeled at the summit, lax, glabrous or hirsute; ligules 1·1·5 mm. long, membranous, truncate, ciliate.

Inflorescence of 2 spiciform racemes, rarely 3, from 3-8 cm. long, erect, spreading or almost appressed to one another, rather thick, hairs scattered; rhachis fragile; pedicels and joints excavated at the base (in the angle, so that they appear to be separated from the sessile spikelet by a pore-shaped space), 2·2·7 mm. long, trigonous, exterior angle with rigid hairs, the interior angles glabrous or shortly ciliate. *Sessile spikelets* green, reddish or splashed with violet, ovate oblong, 4·5·5 mm. long; callus very short, oblong, bearded; lower glume 3·5-5·2 mm. long, coriaceous towards the base, papyraceous towards the top, obovate-oblong, obtuse, 2-toothed, very broadly winged on each side, margins inflexed, auricled at the base, wings erose, ciliolate, back convex, the upper portion scrobiculate (sawdusty) or not, scabrid, glabrous or not, 5-7-nerved, nerves very visible below the summit; upper glume 4·5-5 mm. long, papyraceous, ovate-lanceolate, acuminate or shortly aristate, summit recurved and its keels narrowly winged, dorsally glabrous or ciliate, 3-5-nerved. *Lower floret*; lemma 3-5 mm. long, hyaline, membranous, lanceolate, acute, glabrous or ciliolate, 1-3-nerved; palea equal in length to the lemma, oblong-lanceolate, papyraceous in the centre, 2-nerved, margins incurved, thin, hyaline. *Stamens* 3; anthers 2·5-3 mm. long. *Upper floret*; lemma 2·7-3·5 mm. long, hyaline, ovate-oblong, two-lobed towards the middle,

glabrous or ciliolate, 3-nerved at the base, lobes oblong, ciliolate; awn 3-12 mm. long, slender; column straight, very short, brown, hardly exserted; palea 2.5-3.2 mm. long, linear-oblong, acuminate, 2-nerved, glabrous; anthers reduced. *Style* and stigmas short. *Pedicelled spikelets* 3.5-5 mm. long, obovate; callus acute; lower glume with auricles at the base, glabrous or with sparse hairs; upper glume muticons, ciliolate, keels often hairy. *Upper floret* hermaphrodite, often aristate, the remainder as in the sessile spikelet.

Common in both valleys.

var. wallichii (*Hack.*) *Bor*, Ind. For. Rec. (Bot.) I. 3. (1938) 98.

Pores at the base of the pedicel of the pedicelled spikelet indistinct; joint and pedicels with yellowish golden hairs on the outer angle. *Sessile spikelets* with a callus 1.5 mm. long, with a fulvous beard, separated from the glume by a deep furrow, the latter 5.5-6 mm. long. *Upper lemma* of the pedicelled spikelet with an imperfect awn 5.6 mm. long. *Culms* over 60 cm. tall; leaves 8-15 cm. long, 6-8 mm. broad, occasionally black, hirtellous on both sides, with tubercular-based hairs at the base. *Racemes* 4-7 cm. long, lower glume of sessile spikelet long pilose above.

Plains of ASSAM.

4. Ischænum hubbardii *Bor*, Ind. For. Rec. (Bot.) I. 3. (1938) 98.

A perennial grass. *Culms* smooth and glabrous; base strongly compressed, and covered with the old sheaths. *Lower leaves* petioled, upper auriculate, tapering to a sharp point, covered on both surfaces with tubercle-based hairs, 5-14 cm. long, up to 12 mm. broad; ligules long, lacerate.

Inflorescence of two racemes; joints of the rhachis triangular in cross section, 6 mm. long, densely ciliate on the outer edge, toothed at the top. *Spikelets* in pairs, one sessile, the other pedicelled. *Sessile spikelet*: lower glume flat or slightly convex on the back, oblong, glabrous and minutely scabrid, 6-7 mm. long, narrowly winged on the margins above the middle, purple; margins narrowly incurved, acute or two-

toothed at the top; upper glume cymbiform, 8 mm. long, keeled; keel with a very narrow scabrid wing above the middle. *Lower floret*; lemma 6 mm. long, ovate-lanceolate, hyaline, obscurely 3-nerved; margins narrowly incurved; palea oblong, acute, 4·5 mm. long, hyaline. *Upper floret* hermaphrodite; lemma 5 mm. long, cleft to the middle; lobes glabrous, acute; awn in the sinus, stout, twisted, geniculate, up to 20 mm. long; palea lanceolate, obtuse, 3·5 mm. long, hyaline. *Pedicelled spikelet*; pedicel 3·5 mm. long, concave, back rounded, densely ciliate on the back, toothed at the top. Spikelet occasionally reduced to the glumes only. *Lower glume* oblong-acute, oblique, many-nerved, purple, 5 mm. long, broadly winged on one side; upper glume cymbiform, membranous, shortly aristate, smooth and not winged on the back. *Lower floret* usually male; lemma 4 mm. long; palea 3 mm. long. *Upper floret* absent.

A common grass in the KHASI and JAITIA HILLS, 4-5,000 ft.; in swamps on the plateau near Cherrapunji.

5. **Ischænum hirtum** Hack.. Mon. Androp. (1889) 228.

Culms ascending, base often decumbent, rooting at the nodes or sub-erect, robust, 30-60 cm. tall, unbranched, long exserted at the top. *Leaf-blades* linear-lanceolate, acuminate, up to 20 cm. long by 4·5 mm. broad, hirsute on both surfaces with long tubercle-based hairs, midrib distinct above, nerves numerous, margins thickened and scabrid; sheaths rather lax, striate, smooth and glabrous below, hirsute above; ligules membranous, truncate, glabrous.

Inflorescence of spike-like racemes, 2- rarely 3- nate, pressed closely together, 3·5-5 cm. long, hairy; joints and pedicels 2/3-rds the length of the sessile spikelet, with whitish-grey, rigid hairs on the outer angles, the interior angles with spreading, soft, short hairs. *Sessile spikelets* with a callus 1·5 mm. long, densely bearded with long hairs. *Spikelets* 6-7 mm. long, variegated green and purple. *Lower glume* chartaceous, nerved in the lower part, not winged, with margins broadly inflexed below, slightly above, hairy on upper part, 7-11-nerved. *Upper glume*; apex recurved and shortly aristulate, 3-nerved,

glabrous, scabrid on the keel and back; lower floret male or empty; lemma lanceolate 4 mm. long, broadly inflexed from the nerved keels, ciliate on the margins; palea as long as the lemma but broader, linear-oblong, hyaline, 2-nerved; upper floret hermaphrodite; lemma 4 mm. long, bifid for half its length; lobes lanceolate, ciliate on the margins; awn very short, inserted in the sinus; anthers 3 mm. long; stamens 3. *Pedicelled spikelets*, lanceolate, violettish; callus 1 mm. long, and long bearded. *Lower glume* narrowly lanceolate, setaceous-acuminate, not winged, long hairy in the upper half; upper glume ovate-lanceolate, setaceous-acuminate, 5-nerved, keel sub-glabrous, long ciliate.

Common about Mawphlang in marshy ground; roots many, fibrous.

6. *Ischæmum timorense* Kunth, Revis. Gram. (1829) 369, t. 98.

Slender herbs. *Culms* rooting at the base, almost compressed, slender, simple or branched, more or less bare at the summit, nodes glabrous or shortly pubescent. *Leaf-blades* lanceolate or linear-lanceolate 3-10 cm. long by 3-7 mm. wide, smooth or scaberulous, margins scabrid; petiole slender 5 mm. long, base attenuate, rounded; shortly acuminate, soft, glabrous or with appressed hairs; sheaths compressed, lax, throat not auricled, very glabrous or pubescent towards the throat; ligules very short, membranous, rounded, truncate.

Inflorescence of 2 spiciform racemes, greenish or brownish, 2-5-7 cm. long, with sparse hairs, one sessile or shortly pedicelled, the other with a pedicel 3-6 mm. long; joints 2-5-3 mm. long, outer angle with rigid hairs, almost erect, 8-1-5 mm. long, interior angle shortly ciliate; joints and pedicels excavated towards the inner angle. *Sessile spikelets* ovate-lanceolate, 2-5-4 mm. long; callus linear oblong, .5 mm. long, long-bearded; lower glume 2-5-4 mm. long, ovate or ovate-lanceolate, acuminate and almost depressed at the summit, bicuspide, margins involute near the base, broadly rounded, auriculate at the base, smooth, strongly 5-9-nerved, scabrid, a little coriaceous and polished at the base, thinner above, convex on the back; upper glume 4 mm. long, membranous at the top, lanceolate, acuminate or aristate, rounded

on the back, recurved, obscurely 2-toothed, keel obscure in the lower half, back glabrous or ciliate, margins hyaline, inflexed and ciliate, 3-5-nerved. *Lower floret* empty or male; lemma 2·5-3·5 mm. lanceolate-acute, margins hyaline, membranous, 1-nerved; palea 2·5 mm. long, sub-membranous, linear-oblong, 2-nerved, margins infolded, broadly hyaline. *Upper floret* hermaphrodite; lemma 3 mm. long, ovate-oblong, hyaline, 2-lobed; lobes lanceolate acute or acuminate; margins ciliolate; awn slender 6-9 mm. long, column brownish, hardly exserted. *Pedicelled spikelets* small, elliptic-lanceolate, awned.

Common throughout the province.

33. SEHIMA Forsk.

Spikelets 2-nate, those of each pair differing in sex, one sessile, the other pedicelled on the articulate, fragile rhachis of solitary spike-like racemes, the pedicelled tardily separating from their pedicels, the sessile deciduous together with the adjacent joint of the rhachis and the pedicel. *Florets* 2; lower male, upper hermaphrodite in the sessile, male or neuter in the pedicelled spikelets. *Sessile spikelets*; glumes equal or sub-equal; lower glume flat, 2-dentate, or 2-mucronate, more or less chartaceous, upwards acute, 2-keeled, with inflexed margins; upper glume boat-shaped, keeled upwards, with a bristle-like awn. *Lemmas* hyaline; of lower floret entire, muticous; of upper 2-fid and awned from the sinus. *Paleas* more or less equalling their lemmas, hyaline. *Lodicules* 2, cuneate. *Stamens* 3. *Stigmas* linear-oblong, laterally exserted. *Caryopsis* oblong, obtusely trigonous; embryo reaching to the middle of the grain. *Pedicelled spikelets* flat, with 2-florets resembling the lower floret of the sessile spikelet, the lower or both more or less reduced and barren.

Perennial or annual grasses; blades convolute when young, at length flat, narrow; ligule a line of stiff hairs; racemes usually gently curved, dorsi-ventral and laterally compressed, with the pedicelled spikelets converging over the convex side; joints and pedicels sub-linear and parallel.

- Sehima nervosum** Stapf in Flor. Trop. Afr. IX (1917)
 36. Syn. *Ischænum laxum* R. Br., Prodr. (1810) 205.

A densely tufted pereennial grass. *Culms* slender, terete, glabrous, smooth or slightly rough below the inflorescence, up to 1 m. tall. *Leaf-blades* linear, tapering to a filiform tip, up to 40 cm. long, 3-8 mm. broad, rigid, scabrous, glabrous; sheaths glabrous or hairy, striate; ligule a rim of short stiff or silky hairs.

Inflorescence a solitary raceme, up to 10 cm. long, erect, somewhat nodding; pedicels and joints rather compressed, 2-angled, densely ciliate along the angles, 4-5 mm. long. *Sessile spikelets* 6-8 mm. long, linear to linear-lanceolate, acuminate, pale green in colour, callus shortly bearded. *Lower glume* 6-7 mm. long, chartaceous in texture, 2-toothed, sometimes mucronate, deeply grooved on the back below the middle, 2-keeled, winged on one keel, 6-nerved, with nerves anastomosing. *Upper glume* sub-chartaceous, boat-shaped, keeled above and narrowly winged, aristate, 5·5-6·5 mm. long; arista up to 1·5 cm. long. *Lower floret* male; lemma 6 mm. long, lanceolate, hyaline, ciliate; palea linear, obtuse; stamens 3. *Upper floret* hermaphrodite; lemma hyaline, deeply cleft at the apex into two lobes; an awn, 2·5 cm. long, issues from the cleft; anthers up to 4 mm. long, sometimes absent. *Pedicelled spikelets* as long as the sessile, lanceolate-acuminate, often purple in colour, glabrous. *Lower glume* lanceolate, strongly 7-nerved, of which the inner three are very prominent and scabrid; upper glume sub-chartaceous, lanceolate, finely and long acuminate, 3-nerved, margins ciliate; lower floret male or empty; lemma lanceolate, hyaline, nerveless, paleate; upper floret male or empty; lemma similar to the lower, not awned.

Not collected in ASSAM but likely to occur.

34. APLUDA Linn.

Spikelets in threes at the tips of the branches and branchlets of a leafy panicle, each three supported and embraced by a boat-shaped spathe, borne on a minute peduncle, and deciduous from it as a whole together with the bulbous basal joint of the raceme, or the pedicelled spikelet disarticulating separ-

ately if fertile. *Terminal spikelets* small, barren or almost suppressed, on a flat strap-shaped, broad, glume-like pedicel. *Sessile and lateral pedicelled spikelets* similar in shape, both muticous or the sessile, awned, alike in sex, or more often the pedicelled purely male. *Florets* 2; lower male, upper hermaphrodite or usually male in the lateral pedicelled spikelets. *Glumes* equal, herbaceous-chartaceous, or sub-coriaceous towards the base; lower convolute with the margins not or very narrowly inflexed, upper keeled. *Lemmas* hyaline, of the lower floret muticous, of the upper deeply 2-fid and awned from the sinus or nearly or quite entire and muticous. *Pa'ea* hyaline. *Lodicules* 2-cuneate. *Stamens* 3. *Stigmas* laterally exserted. *Caryopsis* oblong, slightly laterally compressed; scutellum reaching to beyond the middle.

Perennial or annual grasses; blades flat; ligules membranous. *Panicle* compound, leafy, the ultimate branches which bear the spikelets clustered.

Key to the species of *Apluda*.

Sessile spikelets awned.	..	1. <i>A. aristata</i> .
Sessile spikelets awnless	..	2. <i>A. mutica</i> .

1. *Apluda aristata* Linn., Cent. ii. 7. Syn. *A. varia* Hack. sub-sp. *aristata* Hack., Mon. Androp. 196.

A leafy, perennial grass. *Culms* up to 2·5 m. tall, solid, cylindrical, smooth and glabrous, geniculately ascending from a decumbent base or erect; roots wiry; branches flexuous. *Leaves* 10-35 cm. long, sub-bifarious, linear-lanceolate, cuspitately acuminate, base narrowed or usually petioled, upper surface and margins scaberulous, glaucous beneath; upper leaves small; sheaths glabrous, rarely hairy, upper shorter and dilated into spathes with subulate, imperfect blades; ligule membranous, short, rounded.

Inflorescence a leafy panicle made up of very many solitary, simple racemes or false spikes, terminating the stem and its branches, each enclosed in the membranous, peduncled spathe. *Spikelets* in threes; one sessile, two pedicelled; one of the pedicelled is seated upon a broad, strap-like, glabrous pedicel, the other is represented by the pedicel with or without the rudiments of a glume upon it. *Sessile spikelets* herma-

phrodite seated upon the bulbous base of the rhachis; lower glume 4.5 mm. long, chartaceous, many-nerved, somewhat convolute, margins not inflexed; tip obtuse; upper glume boat-shaped, often 2-mucronate, compressed, 4.5 mm. long, keeled, keel glabrous, dorsally gibbous, depressed above, 5-7-nerved. *Lower floret* male; lemma ovate-lanceolate, hyaline, 4 mm. long; palea oblong-lanceolate, hyaline; stamens 3. *Upper floret* hermaphrodite; lemma ovate, 3.5 mm. long, hyaline, cleft half way down, lobes ovate-acute, awned in the cleft; awn 9 mm. long, twisted; palea hyaline, ovate-obtuse. Terminal pedicelled spikelet male; lower glume 4.75 mm. long, lanceolate, many-nerved, compressed at the apex, rounded on the back; upper glume similar. *Lower floret* male; lemma 4 mm. long, ovate-lanceolate, hyaline, scaberulous above, shortly ciliate on the margins; palea lanceolate, hyaline, margins inflexed. *Upper floret* male; 4 mm. long, ovate-acute, hyaline; palea hyaline, oblong-obtuse, 2 mm. long. *Stamens* 3. *Anthers* 2.75 mm. long.

Common in plains and hills up to 5,000 ft.

2. *Apluda mutica* Linn., Sp. Pl. (1753) 82. Syn. *A. varia*, Hack. sub-sp. *mutica* Hack., Mon. Androp. 196.

Differs from *A. aristata* Linn. in that the upper lemma of the sessile spikelet is awnless and the upper glume glabrous and acute.

KHASI and JAITIA HILLS, 5,000 ft.

35. VOSSIA Wall. et Griff.

Spikelets 2-nate, those of each pair alike in shape and sex (or the pedicelled male), on the moderately fragile, articulate rhachis of digitate, rarely solitary, spike-like racemes, sessile separating only very tardily together with the contiguous joint of the rhachis and the pedicel; joint and pedicel slightly gaping. *Florets* 2; lower male, upper hermaphrodite, or sometimes male in the pedicelled spikelets. *Glumes* unequal; lower coriaceous, flat on the back, produced into a long tail like acumen, 2-keeled, narrowly inflexed along the margins; upper boat-shaped, chartaceous, keeled. *Lemmas* hyaline, of lower floret 2-nerved, of upper faintly 3-nerved,

paleas 2-nerved. *Lodicules* 2, large, broadly cuneate. *Stamens* 3. *Stigmas* linear, laterally exserted. *Grain* unknown.

Perennial from a rooting base, often floating; blades long and flat; ligules membranous ciliate; racemes sub-terete or more or less compressed; joints compressed below, widened above; pedicels similar but narrower and flatter.

Vossia cuspidata Griff., Notul. III; index p. 12; Ic. Pl. Asiat. t. 133. *Syn. V. procera* Wall. & Griff. in Journ. Asiat. Soc. Beng. V. (1836) 573.

Perennial. *Culms* submerged or floating, copiously rooting from the submerged nodes, as thick as the finger below, very many-noded, terete, perfectly smooth and glabrous, branching below, the aerial part up to over 1 m. high. *Leaf-blades* linear, long-tapering to a fine point, up to 1 m. long by 2-2·5 cm. wide, convolute in vernalation, then flat, rather rigid, rough on both sides, glaucous, glabrous, midrib very stout below, lateral nerves numerous; leaf-sheaths glabrous and smooth or more or less scaberulous with small tubercle-based hairs, tight or the lower somewhat loose, mostly exceeding the internodes; ligules very short, truncate.

Racemes pale green or straw-coloured, solitary or 2-6 on a short common axis, opposite, 15-22·5 cm. long, erect, rigid or slightly nodding, stout; joints about 8 mm. long, more or less convex or almost flat on the back, scabrid along the angles, disarticulating horizontally; pedicels as long as the joints or slightly longer, scabrid along the angles. *Sessile spikelets* with a narrow contracted callus, ovate, oblong, without the tail, 8 to over 10 mm. long. *Lower glume* ovate-oblong, with a straight subulate tail, up to 2 mm. long and 2 mm. wide at the base, smooth and shining on the back, spinulosely scabrid along the keels and the edges of the tail, many nerved if observed in transmitted light. *Upper glume* about 8 mm. long, ovate-oblong in outline, mucronulate, spinulosely scabrid on the keel, otherwise glabrous, 5-9-nerved, the pair of lateral nerves sub-marginal, the inner or also the outer anastomosing with the middle nerve above. *Lower floret*; lemma 8 mm. long, oblong-lanceolate, minutely 2-dentate, 2-keeled, glabrous except the ciliolate tips, with a linear-oblong, 2-nerved palea.

Upper floret hermaphrodite, similar to the lower, except that the lemma is acute and 3-nerved. *Anthers* 4 mm. long. *Stigmas* over 2 mm. long. *Pedicelled spikelets* similar to the sessile, usually slightly smaller.

DARRANG, SYLHET, GOALPARA, in depressions flooded in the rains.

36. THYRSIA Stapf.

Spikelets 2-nate, those of each pair very similar in shape, or the pedicelled more or less reduced or quite rudimentary, different in sex (occasionally some homogamous in the same inflorescence) on the fragile, articulate rhachis of racemously arranged or panicle-like racemes; joints and pedicels stout, posticously contiguous or almost so; articulation at right angles to the rhachis; tips hollowed out, not appendaged. *Sessile spikelets*; florets 2, lower reduced to a barren lemma, upper hermaphrodite, awnless. *Glumes* equal, coriaceous or more or less chartaceous or the upper membranous; lower flat on the back, smooth, 2-keeled, narrowly inflexed along the margins, muticous; upper boat-shaped, keeled. *Lemmas* hyaline, awnless, of lower floret 2, of upper 3-nerved. *Palea* of upper floret hyaline, 2-nerved; *lodicules* 2, cuneate. *Stamens* 3. *Stigmas* laterally exserted. *Grain* oblong, dorsally compressed; scutellum extending beyond the middle.

Tall coarse grasses; blades very long, hard, flat; ligules very short, membranous; racemes rather stout and stiff, more or less distinctly dorsi-ventral and sometimes sub-moniliform owing to the constriction between the swollen joints and pedicels.

Thyrsia zea (*Clarke*) *Stapf* in *Hook. Ic. Pl. XXXI*, sub. t. 3078. 1922. *Syn. Rotthelia zea* C. B. Clarke in *Journ. Linn. Soc. XXV* (1889) 86. t. 38.

Culms 2 m. tall, rounded, very glabrous with the flower-bearing branches at the summit. *Leaves* linear, almost as broad as the top of the sheath, flat or rolled, rigid, hairy at the base, scabrid above, smooth below, margins very serrulate-scabrid, ciliate, reaching 1 m. in length by 1-2 cm. broad; median nerve thick, broad and white above; sheaths rather

compressed, keeled above, nodes puberulous; ligules very short, truncate, membranous, hirsute.

Inflorescence a sub-compound panicle, ovate-oblong, 25-40 cm. long, rather dense; common rhachis extended; lower spiciform racemes often sub-verticillate in fours, the upper arranged in a spiral, all spreading-erect, compressed; peduncles 2-5 cm. long, the lower with often 2-5-divisions, the upper (rarely all) simple; the lower spiciform raceme longer than the upper, slender, glabrous; rhachis 1 mm. thick; joints 4 mm. long, linear or claviform, incurved, sub-compressed, angular on the back, glabrous on with the back, scabrid; articulation straight, disarticulating and leaving a semi-orbicular scar, slightly concave. *Sessile spikelets* 4 mm. long, sub-oblique, ovate, glabrous, exceeding in all places the cavity in the rhachis, muticous, dorsally compressed; callus very narrow, in the form of a ring separated from the glume by a deep transverse channel, obscurely coloured, glabrous. *Lower glume* 4 mm. long, papyraceous-membranous, keels coriaceous, obtuse, entire, margins narrowly inflexed, folds narrowly scarious, keeled, serrulate, very scabrid, back almost depressed, punctate, scaberulous, 1-3-nerved; lateral nerves short. *Upper glume* 4 mm. long, membranous or coriaceous, ovate-acute, 3-nerved, keel smooth. *Lower floret*; lemma 4 mm. long, hyaline, lanceolate-acute, 2-nerved, empty. *Upper floret* hermaphrodite; lemma 3.5 mm. long, hyaline, ovate oblong, subacute, glabrous, very delicately 2-nerved; palea 1.75 mm. long, hyaline, ovate-oblong, sub-acute, delicately 2-nerved; anthers 2.5 mm. long, filaments short; stigmas short linear, equalling the styles. *Pedicelled spikelets* 3.4-3.8 mm. long, oblong, almost similar to the sessile in other characters; pedicels 1.2-2 mm. long, free, laxly appressed, a little compressed.

Common in the hills in grassland, 3-4,000 ft.

37. HEMARTHRIA R. Br.

Inflorescence of false spikes, compressed, often curved, more or less subulate at the top, tough or at last caducous, enclosed in a spathe; joint and pedicels fused into internodes which are hollowed out to take the sessile spikelet. *Rhachis* tardily disarticulating, articulations straight or almost so,

joints truncate at the top, not hollowed, without an appendage; spikelets 2-nate, similar in sex and shape or almost so, opposite at the fusion of the joints and pedicels, each pair formed of a sessile and a pedicelled spikelet, which is the pedicelled spikelet corresponding to the sessile spikelet of the pair below. *Sessile spikelets* 2-flowered; glumes equal or almost so, the lower with a flat back, 2-keeled, narrowly inflexed on the margins, coriaceous or sub-coriaceous, filling the cavity formed by the adjacent joint and pedicel; upper membranous, adhering to the inner surface of the cavity. *Lower floret*; lemma 1-2-nerved. *Upper floret* hermaphrodite; lemma nerveless; palea small, hyaline, nerveless; lodicules 2, cuneiform. *Stamens* 3; stigmas exserted laterally. *Caryopsis* oblong, somewhat flattened on the back, hilum punctate, almost basal. *Pedicelled spikelets* with glumes more or less long acuminate (above all those of the terminal spikelets); upper glume mucronate or aristate.

Perennial herbs, decumbent or ascending. *Leaves* linear.

Key to the species of *Hemarthria*.

Spikelets less than 6 mm. long :—

- Weak, rarely erect; spikelets 4·4-5 mm. long; upper glume of pedicelled spikelets acuminate, 7-9-nerved; lower glume obtuse, two-toothed; tip often oblique, often contracted below the apex. 1. *H. compressa*.
- Stout, erect; spikelets 4·5-5 mm. long; upper glume of pedicelled spikelets awned, 1-3-nerved; lower glume of sessile spikelet acute, not contracted below apex. 2. *H. protensa*.
- Spikelets over 8 mm. long. 3. *H. longiflora*.

1. *Hemarthria compressa* R. Br., Prod. (1810) 207.

Syn. *Rottboellia compressa* Linn. f., Suppl. 114.

Perennial. *Culms* compressed, erect or decumbent, often branched, sometimes with pubescent nodes; flower-bearing branches solitary or ternate, short, simple or very rarely somewhat branched, surrounded by sheaths. Adult leaves flat or almost so, smooth or scabrid above and on the margins, rarely on the slender median nerve below; sheaths not auriculate or hairy in the throat, compressed and keeled, somewhat loose,

much shorter than the internodes; ligules very short, truncate, membranous, ciliate.

Inflorescence of racemes or false spikes, 6-10 cm. long, compressed, erect, the upper often fascicled, sometimes somewhat incurved, exserted slightly from the sheath, herbaceous, dark green; joints of the rhachis glabrous, thickened by the fusing of the pedicel, much shorter than the spikelets, with the back slightly, and the front deeply, excavated, scar and articulation flat. *Sessile spikelets* 4-4.5 mm. long, linear-lanceolate; callus small, distinct, smooth, glabrous; lower glume with a flat back, margins somewhat reflexed, linear-oblong or oblong, obtuse, emarginate, or 2-toothed, often sub-oblique and narrowly winged, marginal fold smooth to the tip, 7-9-nerved in the narrow grooves; upper glume as long as the lower, concave, sub-keeled, very thin, membranous, closely applied and often adnate to the excavation in the rhachis, elliptic-lanceolate or ovate, acuminate, muticous, or very shortly subulate, aristate, 3-5-nerved. *Lower floret*; lemma oblong, obtuse, hyaline, 2-nerved. *Upper floret* hermaphrodite; lemma shorter than that of the lower floret, ovate-oblong, almost nerveless; palea much shorter, linear-obtuse, nerveless, rarely absent. *Anthers* 2.5 mm. long. *Pedicelled spikelets* male, or if hermaphrodite, with rudimentary anthers, scarcely longer than the sessile or equal to them in length, but narrower, linear-lanceolate or subulate, scabrid at the top; pedicel fused to the rhachis; lower glume herbaceous, sub-coriaceous, subulate or narrowly lanceolate, 7-nerved; upper glume free, a little longer than the lower; hyaline but somewhat firm, acuminate or shortly aristate, 7-9-nerved. *Terminal spikelet* with a long pedicel and with glumes longer acuminate than the others.

Found in marshes in plains and hills up to 5,000 ft.

2. **Hemarthria protensa Steud.**, Syn. Pl. Glum. (1854)
359. Syn. *Rottboellia protensa* Hack., Mon. Androp. 289.

Perennial. *Culms* 9.1-8 m. tall, erect from a decumbent base, branched, fastigiate at the summit. *Leaves* linear-lanceolate, contracted in the lower third, acuminate, 6-50 cm. long, 4-6 mm. wide, the adult leaves flat or caniculate, very glab-

rous on both faces and with smooth margins; sheaths somewhat loose, glabrous or with scattered hairs, much shorter than the internodes, those with branches and the terminal much shorter and spathiform; ligules very short, truncate, ciliate.

False spikes slender, straight or somewhat curved, compressed, 10-20 cm. long, hardly exserted from the sheath; rhachis tough with glabrous joints, more slender than those of *H. compressa*, 4.5-5.2 mm. long, with a flat scar; pedicels often straight, adnate to the joints, rarely quite free. *Sessile spikelets* linear-lanceolate, 6.7 mm. long, glabrous, slightly depressed at the base, with an indistinct callus; lower glume 6.7 mm. long, coriaceous, acute, not constricted below the apex, margins inflexed, back flat, 13- to many-nerved, nerves distinct; upper glume 6.7 mm. long, more or less adnate to the rhachis, membranous, elliptic-lanceolate, acute, often aristate, slightly keeled. *Lower floret*; lemma 4.5-7 mm. long, broadly oblong, obtuse, empty. *Upper floret* hermaphrodite; lemma absent or 1.5-1.7 mm. long, hyaline, ovate-oblong; palea shorter, linear-obtuse. *Stigmas* extended, exserted near the base of the spikelet. *Pedicelled spikelets* 6.7 mm. long, almost the same as the sessile; lower glume 6.7 mm. long, acuminate, especially so in the terminal spikelet, aristate, 7-nerved at the top; awn slender, very narrowly marginate. *Upper glume* 6.7 mm. long, free, coriaceous-chartaceous, subulate, ending in an awn often longer than itself, compressed, scabrid, keel very eccentric, raised towards the margins, 1-3-nerved. *Terminal spikelet* with a longer pedicel, and more acute glumes.

Very common in marshes in plains and hills up to 4,000 ft.

3. *Hemarthria longiflora* (*Hook. f.*) *A. Camus* in Lecomte, Flor. Gen. de l'Indo-Chine, VII. 379. Syn. *Rottboellia longiflora* Hook. f., in F.B.I. VII. 154.

Culms 30-60 cm. tall, erect from a decumbent base, smooth, glabrous, spongy below, nodes glabrous or pubescent. *Leaf-blades* linear-lanceolate from a rounded base, 7-15 cm. long by 6.8 mm. wide, smooth and glabrous even on the margins, flaccid; sheaths rather lax, compressed, sub-keeled, glabrous

or with a few scattered hairs; ligules very short truncate, ciliate.

Racemes 10-15 cm. long, stout, about 6 mm. across, compressed, sheathed below; rhachis sub-tetragonal, tough; joints half the length of the spikelets, smooth and glabrous. *Sessile spikelets* 8-12.5 mm. long, exceeding by far the excavation in the rhachis, lanceolate, acuminate, awned; callus short; lower glume 8-12.5 mm. long, coriaceous, lanceolate, extending into a scabrid awn or at least acuminate; back flat and strongly 13-15-nerved; margins inflexed and winged towards the top; upper glume 10 mm. long, often somewhat adnate to the rhachis, chartaceous-coriaceous, ovate-lanceolate, long acuminate, abruptly contracted into an awn shorter than that of the lower glume. *Lower floret*; lemma 5 mm. long, hyaline, ovate-oblong, lanceolate; palea absent. *Upper floret* hermaphrodite; lemma 4 mm. long, hyaline, linear-oblong, obtuse; palea very short; anthers 1.75 mm. long; ovary broadly obovate, 2 mm. long. *Pedicelled spikelets* acuminate, 10 mm. long, of which about half is a scaberulous awsta, very thick coriaceous, somewhat oblique, upper glume similar in shape and size but more delicate in texture; lower floret; lemma oblong-obtuse; 4.5 mm. long, hyaline, 2-nerved; upper floret hermaphrodite; lemma 4 mm. long, hyaline, similar in shape and texture to the lower; palea linear, 2 mm. long.

Not common, but does occur in Sylhet and probably elsewhere.

38. MNESITHEA Kunth.

False spikes solitary at the apex of the culm and of its branches, cylindrical; rhachis very fragile, joints fused to, or embracing the pedicel; articulation straight or slightly oblique, very concave; two excavations at each joint in which are lodged the spikelets. *Spikelets* 3, situated at each node of the rhachis, at least towards the base, one pedicelled, aborted or very rudimentary often only a scale, seated between two others which are sessile; pedicel tightly appressed to the rhachis or fused with it; the sessile spikelets are 1-flowered and fit exactly into the excavation in the rhachis. *Sessile spikelets*; lower glume coriaceous or cartilaginous, not keeled. *Lower floret* male or neuter; lemma hyaline, lanceolate; palea like

the lemma but shorter. *Upper floret* hermaphrodite; lemma hyaline, nerveless or almost so; palea similar to the lemma or rather shorter; lodicules absent. *Stamens* 3. *Caryopsis* ovate-oblong, convex.

Perennial herbs. *Culms* erect. *Leaves* linear, narrow, rather stiff.

Mnesithea laevis (Retz.) Kunth, Revis. Gram. I. (1830) 154. Syn. *Rottboellia perforata* Roxb., Pl. Corom. II. 43, t. 182.

Culms 5-1 m. tall, erect, solid, rounded, 4-5-noded, rather slender, often branched, with flower bearing branches at the upper nodes which are long and simple, very rarely of two unequal arms. *Leaves* at the base somewhat narrower than the sheath, spreading, flat, linear, the upper acute the lower obtuse, 8-35 cm. long, 3-5 mm. wide, glabrous except at the base, smooth above, scabrid below towards the median nerve and on the margins; sheaths rounded, not auricled, keeled, glabrous; ligule short.

Racemes 10-20 cm. long, hardly exserted from the upper sheaths, pale green or almost purplish. Joints at the base of the false spike, rarely throughout the spike, carrying geminate sessile spikelets with a median pedicelled spikelet. Towards the top of the raceme one sessile and one pedicelled spikelet to each joint, joints half cylindrical, 3-5 mm. long, very glabrous, channelled towards the top, or in all the axillary racemes, which have sessile spikelets, narrower. *Sessile spikelets* in twos, placed in two contiguous excavations, which are longitudinal in the direction of the axis of the culm; the common wall often being perforated; the pedicel of the pedicelled spikelets is placed between these two excavations and is adnate to the joint, and carries the rudimentary spikelet. *Sessile spikelets* obliquely oblong, 3-5.5 mm. long, very glabrous; lower glume very coriaceous, more or less obliquely ovate-oblong, obtuse, back convex, more or less foveolate, obscurely 5-7-nerved; upper glume 3-5.5 mm. long, membranous, sub-keeled, almost without nerves, white, for the rest it resembles the lower glume; lower floret male or neuter; lemma 3-4.5 mm. long, oblong-lanceolate; upper floret hermaphrodite; lemma 2.5-4

mm. long, hyaline, oblong-lanceolate. Anthers 2·5-3 mm. long. *Caryopsis* 2 mm. long. *Pedicelled spikelets* rudimentary, reduced to a glume, 5-1 mm. long, almost round, margins laxly infolded; sometimes a very small second glume present.

Common in the plains.

39. HACKELOCHLOA O. Kuntze.

Spikelets 2-nate, one sessile and the other pedicelled, with the pedicels completely adnate to the joints of the rhachis, on the articulate and fragile rhachis of fascicled spike-like racemes, conspicuously heteromorphous, alike in sex or the pedicelled neuter; the sessile deciduous with its joint and pedicelled spikelet belonging to it. *Sessile spikelet*; florets 2, upper hermaphrodite; lower barren. *Glumes* equal; lower cartilaginous, sub-globose; upper chartaceous, immersed in the cavity of the joint. *Lemmas* hyaline, muticous. *Paleas* hyaline, absent from the lower floret. *Lodicules* broadly cuneate. *Anthers* exserted from the apex of the spikelet. *Stigmas* exserted terminally. *False fruit* nut-like, formed by the hardened lower glume of the sessile spikelet and the closely applied joint. *Caryopsis* sub-orbicular, very convex on the back, almost flat on the face; embryo large. *Pedicelled spikelet*; florets 2; lower barren; upper hermaphrodite, or more or less reduced or suppressed. *Glumes* equal, herbaceous, ovate. *Lemmas*, if present, hyaline, the lower without a palea.

Annual grasses, much branched; leaves soft; racemes very conspicuous on account of the grain-like fertile spikelet.

Hackelochloa granularis O. Kuntze, Rev. Gen. Pl. (1891) 776. Syn. *Manisuris granularis* Linn. f., Nov. Gram. Gen. (1779) 40.

Culms erect, up to over 1 m. high, more or less terete below, compressed above, glabrous or hirsute with tubercle-based hairs. *Leaf-blades* lanceolate or linear-lanceolate, from a cordate or amplexicaul base, acute, 5-10 cm. long, 10-15 mm. wide, more or less hirsute from fine tubercle-based hairs, margins ciliate, midrib white and flat above; sheaths loose to inflated, usually more or less compressed, striate; hirsute with

tuberclé-based hairs, usually bearded at the nodes; ligules very short, membranous, ciliate.

False spikes 1·25-2·5 cm. long, about 2 mm. wide, borne on short or long peduncles, partly enclosed in or completely exserted from the supporting spathe-like sheaths, glabrous, pale green; joints linear, 1-1·75 mm. long, the portion corresponding to the pedicel with 2 fine grooves, that corresponding to the rhachis with one broad flat groove, both with distinct scars, that of the joint hollowed out. *Sessile spikelet*, including the short obconical callus, from almost 2·5 mm. to 3 mm. long, glabrous. *Glumes* sub-equal; lower pitted and tubercled, with faint longitudinal often interrupted ribs, nerves numerous, faintly visible from within; upper glume broad ovate-oblong, obtuse, and adhering below to the cavity of the joint, thickened at the tip, hyaline towards the base, 3-nerved. *Lower floret* shorter than the glumes; lemma broadly ovate-obtuse. *Upper floret* 1 mm. long; lemma ovate-obtuse, like the similar palea, nerveless. *Anthers* ·6 mm. long. *Stigmas* up to 1 mm. long. *Caryopsis* less than 1·25 mm. long. *Pedicelled spikelet* as long as the sessile or slightly longer, ovate, herbaceous, green or purplish. *Glumes* equal; lower slightly asymmetrical, one keel widened, scaberulous, nerves 5-7, very marked, green; upper boat-shaped, prominently keeled, keels scaberulous; nerves 5-7. *Lower floret* barren; lemma ovate-lanceolate, acute, hyaline, 2-nerved. *Upper floret*; lemma similar to that of the lower, but shorter and 1-nerved, or like the palea nerveless; frequently the florets reduced or suppressed.

A good fodder to all stages and suitable for hay. Common in plains and hills up to 4,000 ft.

40. ROTTBELLIA Linn. f. (in part).

Spikelets 2-nate on the nodes of the very fragile rhachis of stout, cylindric, perfectly glabrous, spike-like racemes which terminate the culms and their branches (in the latter case spathe-supported), different in sex and usually also in size, colour, and nervation, except those of the uppermost pairs which are barren, homœomorphous and upwards

increasingly reduced, forming a tapering tail-like appendage to the raceme; joints dorsally flattened below, widely cup-shaped and hollowed out upwards, more or less completely fused, although externally marked off, with the equally flattened and upwards very slightly thickened pedicels along their posticus angles, forming a deeply concave rather thin walled receptacle for the reception of the sessile spikelet; disarticulation of the joints at a right angle or oblique to the rhachis, of the pedicelled spikelets slightly oblique leaving a crescent-shaped, slightly concave scar. *Sessile spikelet* pale, triangular in cross section, the narrow callus fused with the bases of the adjacent joint and pedicel into a glabrous ring from the centre of which protrudes a knob fitting into the cup-shaped hollow of the next lower joint, the whole plexus falling together. *Florets* 2, upper hermaphrodite, lower male, awnless. *Glumes* equal; lower coriaceous, flat on the back, with very narrow inflexed margins, 2-keeled upwards, obtuse or sub-obtuse; upper boat-shaped, keeled upwards, acute. *Lemmas* hyaline, 3-nerved. *Palea* as long as or almost as long as the lemmas, hyaline, 2-nerved. *Lodicules* 2, cuneate. *Stamens* 3. *Stigmas* suberect or shortly laterally exserted. *Caryopsis* broad-oblong or ellipsoid, dorsally compressed; hilum large suprabasal; embryo almost as long as the grain. *Pedicelled spikelets* similar to the sessile, but more compressed, green, striate, with 2 male florets, or small or more or less reduced.

Annual, usually coarse grasses, often with stiff roots from the lowest nodes, more or less branched, particularly upwards; blades large, linear-lanceolate, rather wide; ligule membranous, short; racemes dorsi-ventral with the spikelets placed anticously and laterally, the barren terminal appendages often very slender and their imperfect spikelets very narrow, green.

Key to the species of *Rottbællia*.

- Lower glume of the pedicelled spikelet oblong
or elliptic; racemes over 5 cm. long. .. 1. *R. exaltata*.
- Lower glume of the pedicelled spikelet orbicular; racemes up to 5 cm. long. .. 2. *R. goalparensis*.

1. Rottbœllia exaltata Linn. f., Suppl. (1781) 114.

Culms erect up to 3 m. high, branched, branches more or less erect, smooth or rough or even hirsute, terete with a channel facing the branches. *Leaf-blades* linear-lanceolate, tapering to a long fine point, 30-45 cm. long, 1.25-2.5 cm. wide, somewhat flaccid, glaucescent, smooth below, scabrid with minute stiff hairs above, very rough along the margins; sheaths terete, tight or widened upwards, usually hirsute with tubercle-based hairs, sometimes quite glabrous, strongly striate, ciliolate; ligules membranous, brown, stout, rounded, ciliolate.

Racemes 7.5-15 cm. long, stiff, pale yellowish-green, joints 5.7-5 mm. long, rounded on the back, concave on the inner face, smooth, disarticulating with an almost orbicular scar; pedicels slightly shorter than the joints, broad, rounded on the back, concave on the inner face. *Sessile spikelet* 6.25-8 mm. long including the short broad smooth callus, ovate-lanceolate, glabrous. *Glumes* about equal, the lower coriaceous, sub-acute, entire or very minutely 2-toothed, smooth or very slightly rough, intracarinal nerves very faintly visible on the inner surface, about 9, often narrowly winged near the emarginate apex; upper glume boat-shaped, very broad in profile, obliquely acute, about 11-nerved. *Lower floret*; lemma oblong-lanceolate, acute, glabrous, with a palea similar in shape and size, but firmer, rigid, 2-nerved. *Upper floret*; lemma slightly shorter than that of the lower floret, boat-shaped, obliquely ovate in profile; palea narrowly oblong, nerveless, almost as long as the lemma. *Anthers* 2.5-3.75 mm. long. *Styles* almost 2.5 mm. long. *Caryopsis* up to 3.75 mm. by 2.5 mm. pale. *Pedicelled spikelet* about the size of the sessile, but more compressed and (particularly the upper) more or less acuminate, green striate and with 2 male florets, or more or less reduced; the upper consisting of one glume only; lower glume often winged on the keel and the upper on one side, slightly oblique.

Said to be a very valuable fodder for cattle and horses at all stages of its growth. Very common in the plains and in the hills up to 6,000 ft.

2. *Rottboellia goalparensis* Bor, Ind. For. Rec. (Bot.) I. 3 (1938) 100.

Culms erect, up to 2 m. tall, stilt-rooted below, smooth, terete, much branched, deeply channelled opposite the insertion of a leaf or branch, smooth and glabrous. *Leaf-blades* up to 1 m. or more long, erect, rather stiff, linear but tapering away to a very fine point and also tapering at the base to its junction with the sheath, median nerve very prominent below at the base, disappearing towards the tip, both surfaces hirsute with short white hairs or bristles from very broad tubercle bases, margins spinulose-serrulate; sheaths lax, much shorter than the internodes, markedly striate, hirsute with caducous, upwardly directed spines from broad tubercle-bases, finally glabrous; median nerve of the leaf-blade carried down into the sheath for some distance; nodes glabrous; ligules membranous, up to 6 mm. long or very short, reduced to a mere rim.

Racemes 3.5 cm. long, 3 mm. in diameter, stiff, pale yellowish-green, recurved, seated on very rough, long exserted peduncles, joints 4 mm. long, green, striate, rounded on the back, concave on the inner face, thin, smooth, disarticulating with an almost orbicular scar which is hollowed out to receive an appendage from the base of the joint next above, often fused to the pedicel, disarticulating at right angles. *Sessile spikelet* 5.5 mm. long, including the narrow callus, which is separated from the lower glume by a definite furrow, ovate-oblong, obtuse. *Glumes* sub-equal; *lower* 4 mm. by 3.5 mm. obtuse, coriaceous, flat or slightly depressed on the back, margins very narrowly inflexed, 7-9-nerved; *upper glume* boat-shaped or obliquely sentry-box-shaped, chartaceous, closely applied to the cavity formed by the pedicel and the joint. *Lower-floret* male; lemma oblong-obtuse, 3-nerved, hyaline, 3.5 mm. long, margins slightly inflexed; palea rather firm, of the same shape, margins broadly inflexed, striate. *Upper floret* hermaphrodite; lemma broadly oblong, hyaline, obtuse, 1-nerved, 2.5 mm. long; palea hyaline, narrower and shorter. *Stamens* 3, anthers .2 mm. long. *Styles* 2 mm. long; *stigmas* 4 mm. long.

Pedicelled spikelet; pedicels sometimes adnate to the joints, broad, flat. *Spikelet* almost orbicular, broadly elliptic, apex emarginate; lower glume 1·5 mm. coriaceous; upper glume similar in shape, chartaceous; containing one hyaline empty lemma.

KOCHUGAON, GOALPARA.

41. CŒLORHACHIS Brongn.

Spikelets 2-nate on the nodes of the fragile rhachis of slender, more or less compressed, conspicuously dorsi-ventral spike-like racemes which terminate the culms and their usually fascicled spathe-supported branches, different or very rarely alike in sex, similar in shape or the pedicelled more or less to very much reduced; joints and pedicels similar or the latter more slender, linear to cuneate or sub-clavate, dorsally compressed, glabrous, contiguous or nearly so; disarticulation of the joint at right angles to the rhachis, their tips more or less hollowed out, with or without an auriculiform appendage. *Sessile spikelets* dorsally compressed, the narrow transverse callus fused with the bases of the adjacent joint and pedicel into an obscure rim, from the centre of which protrudes a knob fitting into the hollow of the next lower joint, the whole plexus falling together. *Florets* 2; the lower usually reduced to the lemma, rarely with a small palea, always neuter; upper hermaphrodite, awnless. *Glumes* sub-equal; lower flat or slightly convex on the back, smooth or variously sculptured, with narrow inflexed margins, 2-keeled upwards and more or less winged from the keels, obtuse or emarginate, very faintly nerved; upper chartaceous, keeled, acute, 1-3-nerved. *Lemmas* hyaline, of lower floret 2-nerved or nerveless, of upper 3-1-nerved or nerveless. *Palet* hyaline, similar to the lemma, 2-nerved or nerveless. *Lodicules* 2, cuneate. *Stamens* 3. *Stigmas* laterally shortly exserted. *Grain* oblong, dorsally compressed embryo about half the length of the grain. *Pedicelled spikelet* very varied, similar to the sessile or more or less reduced or rudimentary, male or neuter, very rarely hermaphrodite.

Mostly tall coarse perennial grasses, much branched up-

wards; racemes with the not rarely imbricate sessile spikelets placed anticously and the pedicelled laterally.

Key to the species of Cœlorhachis.

- | | |
|----------------------------------------------|-------------------------|
| Joints of the racemes over 3 mm. long. . . . | 1. <i>C. striata</i> . |
| Joints of the racemes 2 mm. long. . . . | 2. <i>C. khasiana</i> . |

1. *Cœlorhachis striata* A. Camus in Ann. Soc. Linn. Lyon (1921) 197. Syn. *Rottbællia striata* Nees ex Steud., Syn. Pl. Glum. I (1854) 361.

Perennial. *Culms* 1 m. tall, rather slender, very glabrous, branches smooth, thickened under the false spikes. *Leaves* green, rather rigid, almost linear-lanceolate with the base narrow and broadly distinct from the sheath, setaceous, acuminate, 6-1·2 m. long, 8-50 mm. wide, the adult leaves flat, margins scabrid; leaf surfaces smooth or glabrous or a few hairs below; sheaths rounded, glabrous or hirsute with fine tubercle-based hairs, the lower exceeding the internodes, the upper shorter, those at the summit of the culms aphyllous, spathiform, outer margins ciliate, often a few hairs about the nodes; ligules glabrous very short, or with a rudimentary limb.

The false-spikes of the inflorescence are fascicled, slender, erect, sub-cylindrical, pale 2·5-5 cm. long, definitely exserted from the sheath; rhachis very fragile, joints 3·7-4·8 mm. long, 1-1·2 mm. in diameter, convex and striate with green on the outside, gradually thickened towards the top, surfaces excised but not excavated. *Sessile spikelet* 4-5 mm. long, glabrous; callus glabrous, very narrow, annular, distinct from the remainder of the glume by a deep groove. *Lower glume*, oblong-obtuse, 4-5 mm. long, coriaceous, with margins smooth and narrowly inflexed, more or less winged below the summit, back convex at the base, with 4-6 striations principally towards the base, often interrupted, the median sometimes hardly marked. *Upper glume* 3·5-4·5 mm. long, chartaceous, ovate-acute, keeled; keel with a sharp angle, smooth. *Lower floret*; lemma 3·5-4·5 mm. long, ovate, acute, hyaline, nerveless; palea 3-3·8 mm. long, hyaline, linear-oblong, obtuse, nerveless. *Upper floret*; lemma

hyaline, ovate, nerveless or obscurely 1-nerved; palea equalling that of the lower floret in shape and size. *Anthers* 2 mm. long, styles equalling the stigmas, linear. *Pedicelled spikelets* small; pedicel equal to the joint in length.

Common in the plains. Often found in *sal* forest in the Haltugaon division.

2. *Cœlorhachis khasiana* Stapf ex Bor, Ind. For. Rec. (Bot.) 1. 3. (1938) 101. Syn. *Rottbœllia striata* Nees ex Steud., Syn. Pl. Glum. (1854) 361; sub-sp. *khasiana* Hack., Mon. Androp. 302.

Pereennial. *Culms* tall, often solid, much branched, terete, smooth and glabrous, leafy to the top, nodes much shorter upwards, ending at the top in fascicles of peduncles. *Leaf-blades* 60-130 cm. long, up to 4 cm. wide, linear-lanceolate, setaceously acuminate, flat, midrib broad, smooth and glabrous on both surfaces, or with scattered hairs from tubercular bases from both surfaces, sometimes hairy at the base and along the margins; margins cartilaginous, scabrid; sheaths much shorter than the internodes, rather loose, contracted at the mouth, striate, smooth and glabrous; margins membranous; upper sheaths very loose and with a much reduced limb; ligules narrow, 1 mm. long, glabrous, convex upwards, membranous.

Inflorescence of numerous racemes emerging in fascicles from spathe-like leaf sheaths, or solitary from each of the upper nodes of the culms; peduncles often capillary and slightly enlarged below the raceme. *Racemes* 2·5-3 cm. long; rachis rather less fragile than in *C. striata*; joints and pedicels smooth and glabrous; joints clavate 2 mm. long, pedicels strap-shaped, of the same length. *Callus* smooth and glabrous 1 mm. long, separated from the spikelet by a distinct groove. *Sessile spikelet* 4 mm. long. *Lower glume* 3·5-4 mm. long, coriaceous, winged on both sides just below the apex, margins narrowly inflexed, nervation obscure. *Upper glume* 2·5-3 mm. long, lanceolate, 1-nerved, boat-shaped. *Lower floret* barren; lemma hyaline, lanceolate, 2·5 mm. long. *Upper floret* hermaphrodite; lemma similar to that of the lower floret; palea shorter, hyaline; anthers just

over 1 mm. long. *Pedicelled spikelets* either much reduced 1 mm. long or only a rudiment, or up to 3 mm. long, well developed and fertile; the lower glume is broadly winged, scabrid on the margins, coriaceous on the margins and the rest chartaceous; when present, fertile lemmas and paleas as in the sessile spikelets.

Common in the KHASI and JAINTEA HILLS, 4-5,000 ft.

42. OPHIUROS Gærtn.

Sessile spikelets in the cavities of the rhachis which they fill completely 2- (rarely 1-) flowered, accompanied at each node by a pedicelled spikelet often reduced to the pedicel which is adnate to the rhachis; glumes glabrous; lower thick, coriaceous or cartilaginous, convex, smooth, obtuse, entire, with margins narrowly and slightly inflexed, very obscurely 7-nerved, spreading at anthesis; callus very narrow, annular, separated from the rest of the glume by a deep channel; upper glume sub-membranous, concave, obscurely carinate, ovate-oblong, obtuse, 0-3-nerved. *Lower floret* male or neuter; lemma hyaline, elliptic-obtuse, obscurely 2-nerved, margins inflexed; palea narrow or absent. *Upper floret* hermaphrodite; lemma hyaline, oblong-obtuse, nerveless or almost so; palea narrow; lodicules 2, cuneiform, truncate. *Stamens* 3. *Caryopsis* oblong or ovate-oblong, convex on both faces, embryo equalling $\frac{2}{3}$ of the caryopsis.

Culms erect, striate, very glabrous. *Leaves* with sheaths glabrous at the nodes; ligules very short, truncate, glabrous. *False spikes* (sub-compound racemes with adnate pedicels resembling true spikes) solitary or fascicled at the summit of the branches of the stem, cylindrical; rhachis very fragile, intimately fused to the pedicel joints, very thick, semi-cylindrical, glabrous, excavated on one face; articulation straight or somewhat oblique, hollowed, cavity concave.

Ophiuros megaphyllus Stapf ex Haines, Bot. B. & O. (1924) 1058.

Perennial. A stout grass 1.5-2 m. tall, or in exceptional cases up to 4 m. tall; culms terete, smooth and glabrous, branched upwards. *Leaf-blades* narrowly ensiform tapering

from base to apex, up to 1 m. or more long, up to 4 cm. wide below, much narrower upwards, flat, rather rigid, aculeate along the margins, spines arising from tubercle bases, more or less hairy on both surfaces; sheaths much shorter than the internodes, upper spathe-like and without a limb, tight or the upper loose, striate, hirsute with tubercle-based hairs, hirsute on the membranous margins; ligules narrow, convex upwards, membranous.

Racemes 5-15, fascicled in the axils of the spathes or leaf sheaths of the upper nodes, 7-10 cm. long (or perhaps longer) on peduncles slightly swollen at the top below the racemes; peduncles long exserted from the spathes, each solitary on a branch with a villous node, often geniculate at the node. *Rhachis* smooth terete, glabrous, fragile, the joints being at right angles to the axis or slightly oblique and the upper face hollowed to receive a projecting knob from the joint next above. *Pedicelled spikelets* suppressed. *Sessile spikelets* sunk in the rhachis joints and quite flush with them, 3·5-4 mm. long. *Lower glume* 3·5-4 mm. long, coriaceous, 7-9-nerved, or obscurely nerved, back flat to slightly convex, with a few pits or completely smooth. *Upper glume* boat-shaped, hyaline to chartaceous, 3-1-nerved. *Lower floret* empty; lemma ovate-lanceolate to broadly-lanceolate, hyaline; 2-nerved, margins slightly inflexed, palea similar but narrower. *Upper floret* hermaphrodite; lemma and palea similar to those of the lower floret.

Common in plains and hills.

19. MAYDEÆ.

Annual or perennial herbs, often with tall culms; leaf-blades linear to lanceolate. *Spikelets* unisexual, dissimilar awnless, the sexes in different inflorescences or in different parts of the same inflorescence with the male above the female; male spikelets 2-flowered, mostly paired, one sessile, the other or both pedicelled, in solitary or panicled spike-like racemes; glumes membranous to chartaceous, enclosing the florets. *Lemmas* hyaline. *Stamens* 3. *Female spikelets* 2-flowered with the lower floret barren, solitary or sometimes paired, embedded in the hollows of a thickened jointed rhachis or enclosed in a thickened sheath or crowded in rows on a thickened rhachis; glumes hardened or thin; lemmas hyaline.

Key to the genera of *Maydeæ*.

Racemes of male spikelets numerous arranged in a terminal panicle; caryopses naked at maturity, arranged on a spongy rhachis.

1. *Zea*.

Racemes of male spikelets solitary at the ends of the branches or accompanying female spikelets :—

Caryopsis enclosed in the hardened involucre or glume.

2. *Coix*.

Caryopsis enclosed in the hardened lower glume :—

Male racemes terminal, the lateral of both sexes.

3. *Polytoca*.

All racemes containing male and female spikelets.

4. *Chionachne*.

I. ZEA Linn.

Inflorescence monœcious with the male spikelets in large terminal panicles of racemes or subdigitately arranged racemes; female inflorescence consisting of numerous female spikelets seated upon a spongy axis representing the fused axes of several spikes. *Male spikelets* 2-nate, one sessile, the other pedicelled, on the inarticulate rhachis, 2-flowered.

Glumes sub-equal, membranous, convex, obscurely 2-keeled; lemmas and palea alike; lodicules 2, fleshy; stamens 3. *Female spikelets* 2-nate in 4-11 longitudinal rows, slightly immersed in the axis, with a lower barren and an upper fertile floret, awnless. *Glumes* similar, very broad, fleshy below, hyaline above, nerveless, ciliate. *Lower floret* barren; lemma resembling the glume, paleate or not. *Upper floret* female; lemma similar to the lower, paleate; lodicules 0. *Grain* subglobose or dorsally flattened.

Tall, stout, annual grasses with large leaves.

Zea mays Linn., Sp. Pl. (1753) 971..

An annual, robust, monoecious grass. *Culms* tall, smooth, rooting from the lower nodes. *Leaf-blades* 30-45 cm. long, 2.5-12 cm. broad, broadly lanceolate, flat, hairy above, ciliate on the margins; sheaths smooth, villous towards the margins; ligule short, ciliate.

Male inflorescence a panicle of racemes. *Spikelets* in pairs, one sessile, one pedicelled, with the pedicel shorter than the sessile spikelet, ovate-oblong, acute, 2-flowered. *Glumes* oblong, or ovate-lanceolate, sub-equal, membranous, acute, pubescent, strongly nerved. *Lower floret* male or barren; lemma a little shorter than the glumes, hyaline, ovate-oblong or lanceolate, truncate, ciliolate, 5-nerved; palea a little longer, 2-nerved. *Upper floret* male; lemma as long as the lower lemma, hyaline, oblong, 2-nerved; palea as long as the lower palea. *Stamens* 3; anthers linear. *Female inflorescence*; axillary, sessile, enclosed in the sheath of the leaf and surrounded by bracts. *Spikelets* sessile, half-sunk in the spongy axis, conical in shape, arranged in longitudinal rows, 2-nate. *Lower glume* emarginate, sub-bilobed, ciliate at the top; *upper glume* acute or 2-lobed, ciliate. *Lower floret* empty; lemma membranous, transversely oblong; palea shorter or absent. *Upper floret* female; lemma membranous, transversely oblong, narrowly enveloping the ovary; palea longer. *Lodicules* 0. *Caryopses* crowded, shining, hard, surrounded by the bases of the glumes.

Extensively cultivated in hills and plains.

2. COIX Linn.

Spikelets unisexual; male spikelets 2-flowered, in twos or threes on a continuous rachis, the normal group consisting of a pair of sessile spikelets with a single pedicellate spikelet between, the latter sometimes reduced to a pedicel or wanting; glumes membranous, obscurely nerved; lemma and palea hyaline; stamens 3; female spikelets 3 together, one fertile and two sterile at the base of the inflorescence, glumes of fertile spikelets several-nerved, hyaline below, chartaceous in the upper narrow pointed part, the first very broad enclosing the spikelet, the margins infolded beyond the two lateral, stronger pair of nerves; second glume narrower than the first, keeled; sterile lemma similar but a little narrower; fertile lemma and palea hyaline; sterile spikelets consisting of a single narrow tubular glume as long as the fertile spikelet, somewhat chartaceous. *Lodicules* 0. *Ovary* ovoid. *Styles* 2, free, slender.

Tall branched grasses with broad flat blades, the monœcious inflorescences numerous on long stout peduncles, these clustered in the axils of the leaves; each inflorescence consisting of an ovoid bead-like, very hard, tardily deciduous involucre, containing the pistillate lower portion of the inflorescence, the points of the pistillate spikelets and the slender axis of the staminate portion protruding through the orifice at the apex. The staminate portion is early deciduous and consists of several clusters of staminate spikelets.

Key to the species and varieties of *Coix*.

Lower glume of the male spikelets narrowly winged :—

Involucres globose :—

Texture of the involucre stony. 1. *C. lacryma-jobi*.

Texture crustaceous or chartaceous. var. *maynen*.

Involucres cylindrical.

var. *stenocarpa*.

Lower glume of the male spikelets broadly winged.

2. *C. gigantea*.

1. *Coix lacryma-jobi* Linn., Sp. Pl. (1753) 972.

An annual grass. *Culms* branching, rooting at the lower nodes, robust, spongy, glabrous, polished, 0.9 to 2 m.

tall. *Leaves* flat, firm, long, cordate at the base, acuminate at the tip, 10-50 cm. long, 2-5 cm. broad; median nerve robust, with very slender secondary nerves; sheaths smooth, long, often very broad; ligules 1 mm. long, frilled, membranous, glabrous.

The inflorescence consists of peduncled, sub-erect, false spikes; peduncle 4-8 cm. *Male spikelets* 2-3-nate, loosely imbricate on a slender rhachis, 8-12 mm. long, up to 2 mm. broad; lower glume papyraceous, ovate, many-nerved, shortly winged along the inturned margins, shortly and densely ciliolate; upper glume thin, oblong-lanceolate, acuminate, 9-nerved. *Lower floret* male, triandrous; lemma membranous, hyaline, oblong-lanceolate, acuminate, feebly 5-nerved; palea hyaline, somewhat 2-keeled. *Upper floret* male (triandrous) or empty; lemma 6-10 mm. oblong-lanceolate, acute, 5-nerved. *Female spikelet* ovoid, entirely surrounded by the hardened bract, forming a bony involucre, yellowish-white or bluish-grey, 6-11 mm. long; lower glume ovate-oblong, acute, papyraceous; upper glume thinner, ovate, attenuate at the top. *Lower floret* female or empty. *Upper floret* female with the lemma as long as the spikelet, ovate-oblong; palea a little shorter. *Caryopsis* ovoid or globose.

Cultivated in all hill districts. Also found wild in marshy places.
var. *stenoarpa* Stapf ex Hook. f. F.B.I. VII (1897) 100.

Involucres 12.5—22.5 mm. long by 3 mm. broad, white; much used for decoration by the Angami Nagas. Common in the Naga Hills.
var. *mayuen* Stapf ex Hook. f. loc. cit.

An annual; fruit crustaceous or chartaceous. Quoted in Kew Bull. (1893) 76, as a synonym for *Coix gigantea*. Found in the Khasi Hills at Nartiang 4,000 ft., and elsewhere.

2. *Coix gigantea* Roxb., Flor. Ind. III (1832) 569.

A tall, erect, perennial grass up to 3 m. tall. *Culms* up to 2 cm. in diameter at the base, terete, smooth and polished. Lower leaf-blades 60-120 cm. long, 2.5 cm. broad, base obtuse or subcordate, very scabrid on the margins, upper leaves erect, narrow lanceolate, 20 cm. long by 2 cm. broad, or longer and narrower, sometimes scabrid above.

The inflorescence consists of sub-erect, ultimately drooping, false spikes or racemes; peduncle 5-15 cm. long, male

spikelets ternate, the central pedicelled, forming six imbricate rows on the raceme. *Male spikelets*; lower glume elliptic or obovate, broadly winged towards the apex, rounded on the back, many-nerved, 1·25 cm. long; upper glume lanceolate pale. *Lower floret* male; lemma pale, hyaline, with a plicate ridge; palea as large; stamens 3; lodicules 2. *Upper floret* barren; lemma smaller, hyaline; palea large; lodicules 2; ovary rudimentary. Involucre of female with a distinct ligule, often conical in fruit; 2 rudimentary pedicelled spikelets included.

KHASI HILLS in marshy places.

3. POLYTOCA R. Br.

Inflorescence consisting of a number (3 or more, usually 3) of fragile male racemes arranged on a peduncle, and several lateral racemes, entirely female or female at the base and male at the top, surrounded by a spathiform sheath and the sheath of the leaf; rhachis almost continuous, slender, softly pubescent in the male part; thick and pubescent in the female part, with hollowed joints. *Male spikelets* 2-nate, pairs alternate, 2-flowered. *Lower glume* ovate, sometimes mucronate; *upper* a little shorter and less rigid. *Lower* and *upper florets* male, or the lower sometimes empty; lemmas and paleas membranous, thin, muticous. *Stamens* three. *Female spikelets* in pairs, one sterile stipitate, the other sessile. *Lower glume* broad, cartilaginous, surrounding the spikelet but the margins not approximate; *upper glume* narrower, rather hard, acuminate; lemmas 2, sub-hyaline or membranous; staminodes absent. *Caryopsis* enclosed by the lower glume and the adjacent joint.

Tall, or moderately tall, monoecious grasses with flat, large and broad leaves.

Key to the species of *Polytoca*.

Male racemes stiff, slender; pedicelled spikelets often rudimentary and pedicels adnate to the rhachis. 1. *P. digitata*.

Male racemes flexuous; pedicelled spikelets free. 2. *P. wallichiana*.

1. *Polytoca digitata* (*Linn. f.*) Druce in Rep. Bot. Exch. Club Brit. Isles. IV (1917) 641. Syn. *P. bracteata* Br. in Bennett Pl. Rar. Jav. (1838) 20, t. 5.

A perennial grass. *Culms* up to 1·5 m. tall, clothed at the base with old sheaths, densely tomentose on the nodes, grooved on one face, glabrous apart from the nodes. *Leaves* flat, linear, acuminated, narrowed at the base, glabrous or hirsute on the surfaces, 45-60 cm. long, by 1·5-2·5 cm. broad; sheaths long, glabrous or hirsute; ligules membranous pubescent.

Inflorescence of terminal, stiff, peduncled male racemes, and of several lateral racemes entirely female, or male above and female below. *Male spikelets* ovate-acute, 6-7 mm. long, glabrous or pubescent, almost all the pedicels rudimentary and fused to the rhachis. *Lower glume* 6-7 mm. long, herbaceous, ovate-obtuse, mucronate, 7-nerved, often pubescent; *upper glume* narrower and a little shorter, papyraceous, ovate-oblong, strongly acuminate, pubescent. *Lower floret* male or barren; lemma 5-6 mm. long, papyraceous, ovate-oblong, acute; palea shorter, thin. *Upper floret* male; lemma 5-6 mm. long, oblong-acute; palea short. *Female spikelets* 2-nate; pedicellate spikelets rudimentary seated on pedicels fused to the rhachis, lanceolate, 12-18 mm. long, at first concealing the fertile sessile spikelets, afterwards spreading; sessile spikelets pale, shining, 6-7 mm. long. *Lower glume* coriaceous, oblong, obtuse, keeled, villous towards the base on the back, shortly ciliate on the margins, enveloping the spikelet; *upper glume* 6-7 mm. long, coriaceous, ovate-acuminate, long-rostrate. *Lower floret* barren; lemma shorter than the glume, sub-coriaceous, ovate-oblong, acuminate; palea 0. *Upper floret* female; lemma ovate-oblong, hyaline, acuminate; palea hyaline, ovate-oblong, acute. *Caryopsis* small, surrounded by the thickened lower glume, pale yellow in colour, polished, oblong, 7-8 mm. long, hairy in the lower half.

Common in both valleys, ascending to 4,000 ft. in the hills. It is said to be a good fodder grass.

2. *Polytoca wallichiana* Benth. in Jour. Linn. Soc. XIX. (1881) 52.

A perennial grass with well-developed stolons. *Culms* smooth and glabrous, leafy. *Leaf-blades* linear, 20-90 cm. long, 2·5-3·5 cm. broad, rough above, rounded at the base; sheaths narrow, hispid with tubercle-based hairs; ligule hardly present. *Inflorescence* a compound panicle made up of racemes of male spikelets closely arranged on a long peduncle, with lateral racemes more or less enclosed in a spathe with 3-7 female spikelets at the base or in the middle of each raceme and often with male spikelets above and below; rhachis softly pubescent between the male spikelets, fragile, thicker and villous in the female portion. *Male spikelets* 2-nate, one pedicelled, articulate on the pedicels, 6 mm. long, with free pedicels, aristate. *Lower glume* ovate, truncate, very smooth, with a few hairs below the summit, 5-11-nerved, toothed or lobed on one side and produced into a candate awl 15 mm. long; *upper glume* sub-equal to the lower shortly aristate, ovate-lanceolate 3-nerved. *Lower floret* empty or male; lemma ovate-lanceolate, 3-nerved; palea narrower. *Upper floret* male; lemma as long as the lower lemma; palea equal, hyaline; lodicules 2. *Female spikelets* 2-nate, the pedicelled 10-20 mm. long, at first erect, afterwards spreading, ovate-lanceolate, one margin membranous, the other ciliolate, reduced to a many-nerved glume; the sessile fertile, 6-7 mm. long. *Lower glume* 6-8 mm. long, chartaceous in the lower half, membranous above, shortly toothed at the apex, hairy below, rounded and clasping the rhachis and fused to it below; *upper glume* shorter and narrower, oblong, tapering, with a short awl. *Lower floret* female; lemma as long as the upper glume, similar in shape and texture with a narrow palea. *Upper floret* absent.

Reported from Sylhet. Common in Chittagong.

4. CHIONACHNE R. Br.

Racemes entirely male with one or more female spikelets at the base at first enclosed in spathiform bracts; rhachis articulate at the base and above each female spikelet. *Male spikelets* 2-flowered, solitary, or 2-nate and then one pedi-

celled. *Glumes* dissimilar, lower herbaceous, shallowly concave with a narrow membranous wing on each side, upper chartaceous or rarely herbaceous, narrower. *Lemmas* similar, membranous, paleate, both staminate or the upper empty. *Lodicules* 2, cuneate. *Stamens* 3. *Female spikelets* oblong, dorsally compressed, 2-flowered. *Glumes* very dissimilar; lower thickly coriaceous, embracing but not concealing the rhachis between its inflexed margins, enclosing the upper glume and floret; upper membranous or chartaceous. *Lemmas* delicately hyaline; the lower empty paleate or not; the upper narrow, its palea wrapped round the pistil. *Lodicules* 0. *Styles* very long. *Grain* orbicular, compressed, ventrally channelled.

Annual or perennial erect grasses with flat narrow leaves.

***Chionachne koenigii* (Spreng.) Thw.** Enum. Pl. Zeyl. (1864) 369. Syn. *C. barbata* Br. in Benn., Pl. Rar. Jav. (1838) 18; *Polytoca barbata* Stapf ex Hook. f. F. B. I. VII (1897) 102.

A robust perennial monœcious grass. *Culms* erect, terete, smooth, hairy on the nodes, up to 1.5 m. tall. *Leaf-blades* flat, linear, tapering to a subulate point, scabrid above, glabrous or hirsute below, 25-60 cm. long, 6-18 mm. broad; margins scabrid; sheaths glabrous or hairy; ligules tomentose.

Inflorescence a panicle made up of racemes of spikelets 2.5-4 cm. long, male or male at the top and a single (or several) female below; rhachis fragile below the female spikelets and between them, slender between the male spikelets, thick between the female, often glabrous; branches often numerous; spathiform sheaths swollen, broad above the base, mucronate above. *Male spikelets* solitary or 2-nate, 6-8.5 mm. long. *Lower glume* 6-8.5 mm. long, herbaceous with a narrow membranous margin, concave, lanceolate-oblong, obtuse, acute or apiculate, strongly many-nerved, glabrous or hairy; upper glume shorter and narrower, papyraceous, dorsally compressed, ovate acuminate, often 7-9-nerved. *Lower floret* male; lemma 5-7 mm. long, membranous,

oblong-acuminate, 3-5-nerved; palea 4-6 mm. long, hyaline. *Upper floret* male or empty; lemma delicately hyaline; palea as long. *Female spikelets* sessile, often solitary at the base of each partial inflorescence, the pedicelled often absent sometimes rudimentary. *Lower glume* 4-6 mm. long, embracing the spikelet and the rhachis, oblong, keeled, very firm, obscurely many-nerved; upper glume as long, membranous, ovate-oblong or oblong, with rounded, ciliate margins. *Lower floret* barren; lemma oblong, 3-5-nerved with a narrow palea. *Upper floret* female; lemma very narrow, truncate, 3-nerved; palea narrow, truncate; lodicules and staminodes absent. *Caryopsis* enveloped in the thickened lower glume, 5-7 mm. long.

Plains of both valleys and up to 3,000 ft. in the KHASI and JAITIA HILLS. Manipur.

APPENDIX 1.

My friend Mr. Narayanaswami has pointed out to me that he considers that to keep the genus *Erianthus* apart from *Saccharum* on the doubtful distinction of the presence or absence of an awn, is anomalous and that in his opinion all the species now included in *Erianthus* should be transferred to *Saccharum*. I am aware that certain botanists do not recognise *Erianthus* apart from *Saccharum* and I give here Mr. Narayanaswami's list of species including some new combinations which he has made. The question of the validity of *Erianthus* as a genus must await further research.

1. *Saccharum longifolium* Munro ex Bth. in Jour. Linn. Soc. XIX: 66 (1861); *Erianthus chrysothrix* Hack. in Oestr. Bot. Zeitschr. XIX : 6 (1891) ; H. f. F. B. I. 7 : 125 (1897).
2. *Saccharum longisetosum* (Anderss.) Narayanaswami; *Erianthus longisetosus* Anderss. ex Bth. in l. c. 67; H. f. F. B. I. 7: 124.
3. *Saccharum elephantinum* (H. f.) Narayanaswami; *Erianthus elephantinus* H. f. in H.F. F.B.I. 7 : 122.
4. *Saccharum filifolium* Steud. Syn. Gram. 409 (1835); *Erianthus filijolius* Nees ex Steud. Syn. Gram. 409; F.B.I. 7 : 123.
5. *Saccharum fastigiatum* Steud. l.c.; Haines in Bot. B. & O. V; 1014 (1924); Blatter & McCann in Jour. Bomb. Nat. Hist. Soc. 32; 288 (1928); *Erianthus fastigiatum* Nees ex l. c. 409 (1855).
6. *Saccharum griffithii* Munro ex Aitchis. in Jour. Linn. Soc. XIX : 191 (1822) ; Blatter & McCann l. c. 287; *Erianthus griffithii* H.f. l. c. 122.
7. *Saccharum Hookeri* (Hack.) Narayanaswami; *Erianthus Hookeri* Hack. Monogr. Androp. 142; H.f. F.B.I. 7 : 125.
8. *Saccharum Ravennae* (L.) Murr. Syst. ed. XIII; 88; Haines Bot. B. & O. l. c. 1014; Blatter & McCann l. c.

287; *Andropogon Ravennae* L. Sp. Pl. ed. 2 : 1481 (1762);
Erianthus Ravennae Beauv. Agrost. 14 (1812); F. B. I. 7 :
121.

9. **Saccharum rufipilum** Steud. l. c. 409; *Erianthus fulvus* Nees ex Steud. l. c.

10. **Saccharum sikkimensis** (H.f.) Narayanaswami;
Erianthus sikkimensis H.f. in F.B.I. 7 : 123 (1897).

11. **Saccharum versicolor** Steud. l. c.; *Erianthus versicolor* Nees ex Steud. l. c. F.B.I. 7 : 124.

APPENDIX II.

ADDENDA.

The genus *Oryzopsis* was added to the Flora of Assam after the TSS. of this volume had been set up in type. The representative of this genus, *O. aequiglumis* Duthie, was collected in the Dzulake Valley above Khonoma in the Naga Hills at an altitude of 8,000 ft. The discovery of this species leads one to believe that the grass flora is very imperfectly known and that further investigation will bring most of the temperate genera of the Himalaya to light.

Oryzopsis will be found to key down to the tribe *Stipeæ*. An amended key to the genera will read as follows:—

Awn tripartite.	..	..	..	<i>Aristida.</i>
Awn simple.				
Floret cylindric or linear oblong; awn knee and hirsute below the knee.	..	..	..	<i>Stipa.</i>
Floret broader; awn very fine, straight, caducous.	..	..	..	<i>Oryzopsis.</i>

ORYZOPSIS Michx.

Spikelets arranged in loose panicles, ovoid or lanceolate, usually awned; rhachilla jointed above the glumes, not continued above the lemma. *Floret* one, hermaphrodite; lemma shorter than the glumes. *Glumes* equal or sub-equal, persistent, usually acute or sub-acuminate, thin, 3-9-nerved, side-nerves often very short. *Lemma* convolute, more or less dorsally flattened, ovate to obovate or lanceolate, 5- (very rarely 3-) nerved, rather rigidly membranous to coriaceous, tips obscurely 2-lobed; callus very broad and short, obtuse; awn from the minute sinus in the tip, jointed on the lemma and readily deciduous, bristle-like, naked; palea almost as long as the lemma or rather shorter. *Lodicules* 2, rarely 3, hyaline. *Stamens* 3. *Ovary* glabrous; styles distinct, short; stigmas plumose, laterally exserted. *Grain* tightly enclosed by the

tightened lemma and palea, oblong, ovoid, ellipsoid or obovoid; embryo small.

Perennial tufted grasses with linear, usually long, flat, flaccid leaves; ligules membranous; panicles effuse or more or less contracted, often lax and often nodding.

Oryzopsis æquiglumis Duthie, Grass. N. W. Ind. (1883) 27.

A stout perennial grass. *Culms* up to 120 cm. tall, smooth and glabrous, usually simple. *Leaves* up to 30 cm. long, by 1 cm. wide, rough on the upper surface, very rough below, dark green, flaccid, linear, tapering to a long acuminate tip, narrowed at the base, scaberulous on the margins, glabrous; sheaths striate, rough, glabrous; ligules long, membranous, lacerate, 5 mm. long.

Inflorescence a very loose nodding panicle up to 40 cm. long, few-branched. Lower branches 2- to 3-nate, up to 18 cm. long, scabrid, naked at the base for 8 cm. then branching and with many spikelets; nodes 9 cm. apart in the lower portion of the panicle; pedicels short and long, 3-10 mm. long, scabrid. *Spikelets* 7.7-5 mm. long, oblong-acuminate in shape, green with pale purple tips. *Lower glume* 7.7-5 mm. long, elliptic acute when flattened, very thin, almost scarious, 5-nerved, the 2 lateral nerves very short; upper glume as long as the lower and of the same texture, 3-nerved, both minutely scaberulous on the dorsal surface. *Lemma* readily disarticulating from the glumes, narrowly elliptic-acuminate in shape, coriaceous in texture, shining and polished, 5-nerved, sparsely or thickly covered with a mat of brownish appressed hairs, 5 mm. long, awned; callus rounded, obtuse, glabrous; awn issuing from a minute sinus at the apex, up to 10 mm. long; palea of the same texture and length as the lemma, almost concealed by the overlapping margins of the lemma, keels rounded, 2-nerved.

DZULAKE VALLEY, KHONOMA, NAGA HILLS, ASSAM, 8,000 ft.

Tripegon bromoides Roth. Nov. Sp. (1821) 79.

A perennial cæspitose grass with wiry roots. *Culms* many, slender or stout, up to 45 cm. tall, smooth and glabrous,

polished. *Leaf-blades* very narrow, 3-4 mm. wide, up to 30 cm. long or very short, flat or convolute, smooth or minutely scaberulous, often minutely hairy or glabrous, with a few long white hairs behind the ligule; sheaths short, smooth, glabrous, polished, remaining long at the base of the culms, long hairy at the throat; ligule very short, membranous.

Inflorescence a spike up to 25 cm. long, rarely branched, with crowded cylindrical, slate-grey spikelets. *Rhachis* flat on the back, straight or flexuous, scabrid on the margins. *Spikelets* secund, crowded, cylindrical, up to 1.25 cm. long. *Lower glume* ovate or lanceolate, shortly aristate, deeply lobed on one side, 1-nerved, scabrid on the keel, 3-4 mm. long; upper glume 5.5 mm. long, oblong-lanceolate, shortly aristate, membranous, scaberulous on the back. *Florets* up 18; lemmas reduced at the apex and sterile. Fertile lemmas 3.5 mm. long excluding the awns, broadly elliptic in shape, membranous in texture, 3-nerved, hairy on the callus, slate-coloured, 3-awned; between the awns the lemma is produced as an acute lobe; the awns are 3-3.5 mm. long; palea elliptic in outline, 2-keeled, scabrid on the keels; margins infolded. *Stamens* 3. *Lodicules* 2. *Grain* 2 mm. long; hilum 1/3 as long.

PEAK, SHILLONG, 5,000 ft.

This species falls into the same section as *T. filiformis* in the key but differs from it in its robust habit and larger spikelets. (See page 113).

ERRATUM.

The correct citation of *Acroceras crassiaciculatum* on page 200 is **A. crassiaciculatum** (Merr.) Alston in Trimen, Handbook Fl. Ceylon, VI. Suppl., (1931) 324, and not as stated.

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